THE

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TEMPERATURE LIMITS.

ELSEWHERE in this issue we give the limiting values for the observable temperatures for different insulating materials employed in the manufacture of modern electrical machinery, as adopted by the International Electrotechnical Commission at its recent meeting held in Berlin. Certain leading features are also referred to which go to show the commercial importance of the work which the I.E.C. is now engaged upon, and for which, to a large extent, it was originally founded. As our esteemed contemporary, the *Electrical World*, rightly observed some time ago, it is reasonable to assume that since the I.E.C. is an international body which arrives at its decisions by a process of international discussion in Committee work and debate, each Nation's successive editions of standardisation rules will certainly converge towards the consensus of opinion as expressed by the I.E.C., with the ultimate aim of the creation of a single set of rules.

This very desirable object can, however, only be attained through the process of time, and should not in any way be forced. Indeed, in international matters it is almost an axiom that to attempt to force a vote upon a point not yet ripe for discussion is highly detrimental to the best interests of those concerned. The Commission, preferring that its decisions should be practically unanimous, has deferred the question of the value to be fixed for the maximum ambient temperature in the hope that a satisfactory solution may be found in the near future, which will be confirmed at the San Francisco meeting two years hence.

With so much goodwill at its disposal and such readiness to defer to the considered opinion of the majority, a striking characteristic of all its debates, we may safely leave to the Commission this problem, the solution of which will mean so much to the electrical industry generally. It should especially affect export business, where simplicity is so necessary to avoid those unfortunate misunderstandings which do much to retard commercial progress and interfere with good feeling between the producer and his clients.

The values now adopted internationally for the highest observable temperatures for different classes of insulating materials are standardised for continuous operation. While, doubtless, recognising that, strictly speaking, the life of insulating material is a function of both time and temperature, commercial expediency has evidently led the Commission to recommend such temperatures as are in accordance with durability when continuously sustained, and which must never be exceeded. The introduction of the time element, notwithstanding its importance, would certainly not be consistent with the simplicity so essential to commercial standardisation, and this is, no doubt, the reason it has been avoided. The object of a standard rating is not only to assist the maker, but also to protect the non-technical purchaser and enable him easily and with confidence to compare tenders received from various countries, even though their own national rules may still differ in their methods of rating.

Experience in Great Britain has proved that standardisation on broad lines has been of great commercial assistance to the industry adopting it. We feel sure, therefore, that

when a definite international basis is established whereby the capacity of any electrical machine may be ascertained correctly, it will have a decided influence on the progress of the whole of the electrical industry.

Rubber.

The market for crude rubber has again justified all the scepticism which has been expressed as to its having reached a thoroughly safe level of values, for within the past fortnight or so a fresh bout of weakness has been seen, with considerable flatness in the share markets. The attempts which have been made to hold up the Para market seem likely to have no more successful an issue than those put forward on previous occasions, and the mere fact that Para is held at a big premium over plantation is adduced as evidence of the unsoundness of the conditions affecting the former. One thing is certain, however, and that is that at present prices the collection of wild rubber will cease not only in Brazil, but also in the Congo and elsewhere. This cannot but have a highly important effect in the long run upon the position of rubber generally, for, with the greatly extended consumption going on, it is hardly likely that the plantations will supply the world's needs at current prices. This may sooner or later involve a rise in values to a level at which wild rubber can again come into force as a market factor. But the immediate price prospect is not very encouraging for the holders of shares in plantation rubber companies, and it seems as if consumers would be able, for a long time to come, to obtain their supplies on easy terms.

The scheme that was propounded some time ago, whereby a certain amount of the output of the plantations should be earmarked for the use of manufacturers at a very low figure compared with that then ruling, provided that the rubber so purchased was used solely for experimental purposes in connection with the discovery of new uses, has fallen through, but in its place quite a new scheme has been launched, and with some prospect of success, although it is stated that one important group of companies will not fall into line. This is a proposal for forming a selling agency to handle the entire output of the plantations in the middle East. The scheme was put forward by the Malacca Plantations, and is now under the consideration of the trade.

The suggestion that the producing companies should pool their output, and that it should be handled by a central organisation, has good points in it, but it is to be hoped, in the best interests of the trade, that such a concern will not make the mistake of attempting to hold up the market by the manipulation of supplies, for if it does, then the last state of the plantation rubber industry will probably be worse than the first. The present position of the trade in Brazil is due, in some measure, to the foolish attempts made to hold up prices in the face of economic disadvantages, and an effort to regulate the plantation trade by means akin to manipulation must fail in the end. For this reason the less the interference with the natural course of events the better.

Probably the central organisation will take cognisance of a number of matters apart from the actual selling of the rubber produced by the constituent companies, in which event it is not unreasonable to look for some regulation of the planting up of new areas. The ultimate extension of production is beyond the wit of man to forecast, but if the raising of prices is the main object of the central concern, then the extension of planted areas on the part of the constituent companies becomes a matter of vital importance. Already quite a number of the plantation companies have decided to cut down severely their programme of new planting; the outlook for prices is at the present time anything but satisfactory, and with rubber not far off the 2s. a lb. mark, the greatest caution should be used in developing productions.

The burning questions to-day, with most companies, are how and in what way costs can be kept down. The rubber trade of the Amazon Valley is now passing through a severe crisis. The Ministry has decided to ask Congress for authority to reduce the export duty on rubber by half, and to endeavour to secure from the Amazon navigation companies a reduction in freights. Sundry other measures of relief are in contemplation, but with business at the rubber towns at a standstill, there are troublous times in store.

Municipal Secrecy in Agreements.

It is well known that the large electrical firms in Germany are constantly endeavouring to acquire control of municipal or communal electricity works either by purchase, leasing, or by the formation of companies in which they are interested jointly with these local authorities. In this connection, the Association of Special Electrical Works (Vereinigung Elektrotechnischer Spezial Fabriken), which appears to avail itself of every opportunity of directing attention to the monopolistic endeavours of the large firms, claims to have discovered a fresh ground for complaint against the latter. It is stated, for instance, that when approaching local authorities with offers to take over their supply works, the large firms make it a condition that the strictest secrecy shall be observed in the matter.

Although publicity in such affairs is highly desirable in that country as in others, the object of seeking to keep the proposals secret is doubtless to minimise any opposition which might arise to the negotiation of the transactions in contemplation. But the Association further alleges that in order to secure the maintenance of secrecy it is arranged, where offers develop into actual schemes, that the draft agreements shall be withheld from the municipal or communal councillors as long as possible. If this is the case, it would be of interest to learn who are the parties to the negotiations on behalf of the town or commune. Yet the Association states that the draft agreement at Saarbrucken in 1912 was laid before the municipal councillors only on the day when a decision was arrived at, and then only in abstract form, whilst at Rostock in May of the present year the councillors received no information of the draft agreement for a lease before the meeting of the Council, when a verbal report was made.

Whatever secrecy may be possible in the preliminary stages, doubts certainly arise as to the possibility of withholding draft agreements from the members of the local authorities, who, as a body, are the contracting parties on the one side, until the final day of decision. Indeed, we should be reluctant to attach credence to the two cases mentioned, in view of the publicity which has taken place in other instances of transfer or leasing of works. If the Association has not been hoaxed in the matter, the situation set forth reveals an extraordinary state of affairs in connection with the management of some municipal supply works in Germany.

The Tramway Conference.

Judging by the proceedings at the Tramway Conference which was held last week at Sheffield, the problems which confront tramway men remain very much the same as a year ago, at the time of the previous Conference.

Any survey of the position must differentiate between London and the provinces. In the former the alternatives appear to be an immediate readjustment of the financial burdens of the tramways, or a continuance of dwindling surpluses—the severity of an indirectly subsidised motor-'bus competition being the main factor in this state of affairs.

After all, any argument which would seek to saddle the tramway with an undue proportion of road maintenance, because it diverts traffic elsewhere, causing increased wear in other directions, must apply with equal force to a stream of motor-'buses, which equally tends to monopolise the two sides of the road, *unless it uses the tramway track.*

It cannot be doubted that a more equitable distribution of road maintenance is urgently needed, and that it can be most easily achieved by relieving the tramways of at least a portion of the present ridiculously unfair charges for this purpose.

In the provinces, the motor-'bus appears only as an ally of the tramways, but the question of road maintenance is nevertheless a matter for consideration, owing to the increasing number of heavy industrial vehicles which use the tramway tracks in the ordinary way.

All tramway men appear to be convinced of the necessity of taking some action, and it only remains to be settled what shall be done.

THE BRITISH ASSOCIATION.—III.

In our last issue we printed an abstract of the paper read in Section G on "Electromagnetic Waves," by Prof. G. W. O. Howe. This was followed by a paper on "Atmospheric Refraction," by Dr. W. H. Eccles, and a further contribution was read by Prof. Marchant, on "The Effect of Atmospheric Conditions on the Strength of Wireless Signals at Liverpool."

All three papers were discussed together, Prof. Fleming opening the discussion. He said that an old conception of the ether was now being taken away, and they were asked instead to adopt the quantum theory of radiation. There was a great deal to learn about "wireless" waves, and although it was generally admitted that the state of the atmosphere had some effect on the signals, it was difficult to reconcile that with the fact that in London, with antennæ only 35 ft. high, and with houses all round, signals were received from Paris without any difficulty. The question was whether the radiation passed entirely outside the earth. He suggested that a society should be formed to embrace all "wireless" experimenters, with the special object of comparing all experiments made, so as to arrive at the facts. He also suggested that at all wireless stations instruments should be fixed to register the strength of the signals under all conditions.

Prof. Nicholson said the difference between the strength of day and night signals must be due to the state of the atmosphere, and showed that the signals passed over, and not through, the earth.

Mr. Rivers-Moore referred to the large number of enthusiastic amateurs engaged in "wireless" experiments, and said he felt sure most of them would be only too happy to co-operate. He referred to the Wilson high-tension discharge apparatus, which was demonstrated in another room. It is claimed that a ½-kw. set is effective up to 200 statute miles.

Prof. Wilson agreed that there was a lack of data. He said that he had proved at King's College that the air was ionised by sunlight, and described the apparatus used by him, which proved that conductivity was increased by the ultra-violet rays.

At the conclusion of the discussion Dr. Eccles announced, as secretary of the Radio-Electric Committee, that a complete scheme was being drawn up for the co-operation of "wireless" investigators.

On the same day Prof. E. Wilson's paper on "Exposure Tests (for oxidation) of Copper, Aluminium and Duralumin," of which we printed an abstract in our last issue, was read and discussed.

A further paper was contributed by Mr. W. R. Cooper, on "Short Heat Tests of Electrical Machines," in which methods were described by which 6-hour runs of electrical machinery might be dispensed with.

Prof. Marchant, referring to temperature curves, said he always found them rather flattened at the commencement of the run, which he attributed to internal heating-up of the metal.

Mr. Mordey said he did not look forward to the possibility of shortening tests, and he thought they were none too long now, as there was not only the electrical heating, but the question of bearings and general running, which required a reasonable length of test before plant was taken out of the maker's works. Questions of balance were not sufficiently considered even now. The average resistance was useless as a guide. What was required was to know which was the hottest part of the machine.

Domestic Electric Cooking and Heating—Results of One Year's Working.

By Prof. J. T. Morris, M.I.E.E.

(Section G. Abstract.)

During the last five years great strides have been made in the construction of the electric cooker, and it may now be confidently asserted that there are makes which are thoroughly reliable.

An important question is, What will the weekly consumption of energy be? If a householder can get an idea of the number of units which would be used, then, knowing the tariff for electric cooking in the district, he can form an approximate estimate as to the weekly cost of electric cooking in his case.

It is the object of this paper, since but few figures of the kind are readily available, to give a definite answer to this question in one particular case, where the daily consumption has been recorded throughout a period of one year. Experience has clearly brought out the following facts:—

1. Those who have tried electric cooking know that joints of meat and steak are cooked better by electricity than by other means, and it is also true that a shorter period of training is required in order to be able to do so.

2. The heavy work in the kitchen is largely reduced, owing to the fact that there is far less coal to be handled, and there is no kitchen range to be cleaned and polished every morning.

3. The certainty that if the same time is given for the same operation exactly the same result will be produced.

4. The convenience and cleanliness and the avoidance of an unhealthily hot atmosphere in the kitchen.

It must be allowed that a difficulty is experienced in the supply of hot water in large quantities, such as for washing up and for baths, where either the electric cooker or the ordinary gas cooker is used. Although special arrangements are obtainable which will deal with these large quantities, the author still has to be convinced that any of them can compete with coke or anthracite slow-combustion stoves, on the score of cost at least.

I believe that, at any rate as far as large blocks of flats are concerned, a central boiler kept permanently fired, will be used for supplying hot water continuously to all of the flats in the block, so that it can be obtained as easily as cold water. (I am informed that this is now being done in certain large blocks of flats.) However, as far as the independent householder is concerned, at least he must have some arrangement for obtaining hot water.

In the present instance the arrangements used for cooking were a Jackson (Marylebone) electric cooker, having three hot plates, two for boiling and one of lower heat for simmering purposes, one grill and a fair-sized oven, the approximate measurements being: height 38 in., width 30 in., depth 24 in. The Board of Trade units when each of the hot plates, &c., were in use individually for one hour, and the cost per hour at ½d. per unit, are given in the following table:—

Hot plates ...	No. 1.			No. 2.			No. 3.		
	Low.	Med.	High.	Low.	Med.	High.	Low.	Med.	High.
Units used in 1 hour	0·36	0·67	1·34	0·36	0·70	1·39	0·24	0·48	0·94
Cost per hour in pence at ½d. per unit ...	0·18	0·33	0·67	0·18	0·35	0·70	0·12	0·24	0·47

	Grill.	Oven. One-third.	Oven. Two-thirds	Oven. 1/3+2/3rds.
Units used in 1 hour ...	1·34	1·06	2·11	3·17
Cost per hour in pence at ½d. per unit ...	0·67	0·53	1·05	1·58

The hot-water supply was obtained by means of a coke boiler, manufactured by the Carron Co. (O-sho boiler), pattern Y.A. It stands 32 in. high and is 14 in. wide by 14 in. deep. Its smoke flue is 5 in. in diameter. As it is not large it is set in a recess, and it gives very little trouble. It requires lighting in the morning, and stoking two or three times a day with coke, and it will burn practically any kind of rubbish. This is a matter which should not be lost sight of, for if all coal fires are done away with in a house difficulties arise with regard to disposing of certain forms of rubbish.

Another matter which requires attention is the proper heating of the kitchen. Of course, under ordinary circumstances, it is oppressively hot in the summer with a coal range. When electric cooking is used, then the kitchen is a much more healthy place, and the extra warmth which is required in winter can be obtained from the coke boiler by leaving its doors open, though naturally it is not then so efficient as far as heating water is concerned.

The table on next page gives the units used each day for five or six persons for a period of 10 months. It will be seen that, neglecting exceptional cases, this quantity varies from 5 to 15 units, depending on the quantity of cooking required. The "record" consumption which occurred on December 16th was due, as might be guessed, to the Christmas pudding. The average daily consumption over the whole period is 9·75 units, which, at ½d. per unit, amounts to 4·87d. per day.

Over the same period of 10 months the quantity of coke used was 6 chaldrons, costing £4 11s., which, taking into account the wood needed to light the fire each morning, comes out at 4d. per day. Hence the running costs for electrical energy to the cooker and for the supply of hot water for all household purposes amounts to 8·87d. per day—that is, less than 9d. per day.

The figures were obtained in a flat having six rooms, a kitchen and a bathroom, and represent the consumption for a household of five persons.

It should be noted that in one room a coal fire was used for part of the period, and therefore the figures for heating are smaller than they would otherwise have been. Further, it should be remarked that there are no gas pipes in the flat. The maximum weekly consumption for heating is 129 units, and this was due to visitors.

With reference to the lighting the maximum weekly consumption will be seen to be 6·5 units, which at a halfpenny per unit comes out at 3¼d. per week. It is interesting to note that this amount is insignificant in comparison with the amount due to the

annual charge, but it should be remembered that this annual charge covers all uses of electricity, though based on the maximum possible *lighting* load.

Table of Daily Consumption in Board of Trade Units for Cooking during the period of September 29th, 1912, to July 26th, 1913.

Week ending	October, 1912. 5	12	19	26	November. 2	9	16	23	30	December. 7	14	21	28
Sunday ...	6	4	7	5	5	5	6	6	8	5	5	5	6
Monday ...	5	6	9	9	5	8	8	8	5	7	21	36	7
Tuesday ...	12	11	14	13	9	11	11	13	12	14	6	17	10
Wednesday ...	11	11	11	6	11	14	13	6	9	7	6	10	13
Thursday ...	9	7	8	9	9	7	8	17	12	9	8	11	5
Friday	15	6	13	10	11	8	12	13	6	8	7	7	3
Saturday ...	14	12	14	12	12	12	14	12	11	12	13	13	6
Weekly total ...	72	57	76	64	62	65	72	75	63	62	66	99	50

Week ending ...	January, 1913. 4	11	18	25	February. 1	8	15	22	March. 1	8	15	22	29
Sunday	5	6	6	7	7	5	6	12	7	6	6	9	8
Monday... ...	5	6	8	13	6	6	5	6	4	10	8	8	7
Tuesday... ...	4	12	13	13	9	6	8	11	13	13	10	11	10
Wednesday ...	5	8	9	12	10	9	7	6	8	10	8	8	12
Thursday ...	9	8	9	6	11	12	10	10	10	8	14	14	7
Friday	7	13	11	9	12	10	5	10	12	8	10	9	14
Saturday ...	13	12	14	17	17	12	6	12	11	14	10	15	13
Weekly total ...	48	65	70	77	72	60	47	67	65	69	66	74	71

Week ending ...	April, 1913 5	12	19	26	May. 3	10	17	24	31	June. 7	14	21	28	July. 5	12	19	26
Sunday	6	8	7	8	7	12	13	10	14	8	8	5	8	8	4	5	5
Monday	11	7	9	6	14	10	8	8	10	10	9	6	8	7	4	4	13
Tuesday	12	11	10	10	11	15	9	13	12	10	11	6	15	8	7	11	8
Wednesday	12	12	7	6	15	14	13	13	14	11	10	2	9	9	13	6	7
Thursday	10	11	15	10	12	10	11	15	11	9	11	10	14	8	10	9	9
Friday	7	16	6	7	10	11	14	13	10	10	11	11	13	7	8	9	10
Saturday	11	18	11	15	16	12	13	14	15	14	9	10	10	9	11	12	10
Weekly total ...	69	83	65	62	85	84	81	86	86	72	68	50	78	56	57	56	62

The individual charges which go to make up the total expenditure throughout the year from July 27th, 1912, to July 26th, 1913, on cooking, heating and lighting, are given below :—

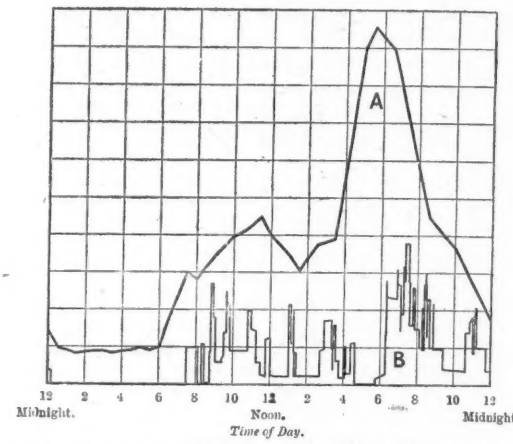
Annual "Telephone" charge	£6	10 8
Hire of cooker at 15s. per quarter ...	3	0 0
Cooking : 2,934 units at ½d.	6	2 3
Heating : 2,068 „ „	4	6 2
Lighting : 200 „ „	0	8 4
	£20	7 5
Coke and wood	4	11 0
	£24	18 5

Since coming to Birmingham I have seen Mr. R. A. Chattock and obtained from him the corresponding figures for this city. He tells me that they do not let out cookers on hire, but have a three years' purchase system by which consumers can buy cookers from the Corporation. Again, Mr. Chattock has no charge corresponding to the "Telephone" charge at Marylebone. The annual cost for the same flat at Birmingham would be :—

One-third purchase of cooker	£6	0 0
Cooking : 2,934 units at 1d.	12	4 6
Heating : 2,068 „ „ 1d.	8	12 4
Lighting : 200 „ „ 2·85d.	2	7 6
	£29	4 4
Coke and wood	4	11 0
	£33	15 4

In comparing this method of heating and cooking with methods in which coal is used, it must be borne in mind that a saving of from £25 to £30 has been made in the cost of domestic service, and therefore on the above tariff it is an indisputable fact that a considerable gain has been made on the score of economy, cleanliness and independence.

A typical load curve is given in the figure of the total current taken for all electrical purposes in the flat on Monday, January 20th, 1913. On the same diagram, through the kindness of Mr. A. H. Seabrook, I am able to show the station load curve for the same day, though to a very different scale. These curves are placed on the same chart with the object of showing that this cooking, heating and lighting load does not reach its maximum at the same time as that at which the peak load of the generating station occurs.



CURVES COMPARING GENERATING STATION LOAD (CURVE A) WITH SHAPE OF COOKING, HEATING AND LIGHTING LOAD DUE TO ONE CONSUMER (CURVE B).

Monday, January 20th, 1913. Fair day. Temp. 45° F.

Experience gained with this electric cooker has suggested the following as some of the directions in which improvements would be specially welcome :—

1. At present a rather serious obstacle in the way of reheating dishes—a common every-day need in most households—is the relatively long time taken in bringing the oven to the working temperature, and consequently the disproportionately large expenditure of energy to effect a comparatively trifling result.

2. The time taken to boil a pint of water, especially the first one in the morning when the cooker is quite cold, might be shortened with considerable advantage.

Weekly Consumption in Board of Trade Units for Cooking, Heating and Lighting during the period from September 29th, 1912, to July 27th, 1913.

Week ending...	October, 1912. 6	13	20	27	November. 3	10	17	24	December. 1	8	15	22	29	January, 1913. 5	12	19	26
Cooking	72	56	75	65	62	66	72	77	61	62	64	100	50	48	65	71	77
Heating	51	31	50	50	31	46	90	45	55	82	42	37	31	45	74	84	68
Lighting	4	3·5	3·5	4·5	5	5·5	5	5·5	5·5	5·5	6·5	5·5	5	6	6·2	6	6·5

Week ending ...	February. 2	9	16	23	March. 2	9	16	23	30	April. 6	13	20	27	May. 4	11	18	25
Cooking	71	62	50	63	65	68	68	72	72	70	84	64	61	89	84	79	90
Heating	80	63	58	60	49	50	61	92	94	96	129	79	48	30	55	55	32
Lighting	6·5	6	5·5	4	5	6	5	4	4	4	6	5·1	4·1	4·5	4·5	4·2	3·5

Week ending ...	June. 1	8	15	22	29	July. 6	13	20	27	Weekly average.	
Cooking	80	73	66	52	78	55	56	56	63	68·2	Cooking.
Heating	1	4	3	2	2	1	5	4	3	48·1	Heating.
Lighting	3·2	3·4	3·1	2·4	3·2	3·3	3·1	3·1	3·3	4·6	Lighting.

3. Cooking utensils, however perfectly flat-bottomed they may be when first supplied, appear, with ordinary wear and tear, too soon to lose this quality, so necessary for economy both in time and energy used.

That these matters are receiving attention at the hands of some designers of electric cookers will be gathered from the following information which the author has received, on the best authority, since the first draft of this paper had been made. The latest form of electric cooker, of which about a dozen are in use at the present time, have the ovens arranged so that the direct radiation from the heater is not shielded in any way, with the result that the time taken for raising the oven to the working temperature has been reduced to about one-half of what it was in the older patterns.

Further, that in a week or two a red-hot plate will be put upon the market which halves the time necessary for raising cold water up to the boiling point, avoids the necessity for special utensils, and is robust, for cold water can be poured upon it with impunity.

It may fairly be claimed, as to safety in use, that of the three most common methods of cooking food the electric cooker is, when properly installed, by far the safest. For instance, there is no chimney to get on fire, nor is there danger from stray cinders, or of explosions, unpleasant fumes or of "firing back."

There is also, as already referred to, the great advantage of perfect cleanliness in use. Saucepans, for instance, can never become sooty outside. This fact alone saves a not inconsiderable amount of labour. Then, too, the walls and ceiling of the kitchen remain much longer clean. When to these two advantages of safety and cleanliness is added that of absolute reliability, it is obvious that electric cooking is an ideal method for use in an ordinary household.

Discussion.

Prof. Kapp, in inviting discussion, said the author had not mentioned the saving electric cookers effected in the butcher's bill.

Prof. Fleming said the greatest trouble he had found in the regular use of electric cookers was the variable and irregular life of the heating elements. When these failed it was not easy to replace them, as makers had not adopted rigid interchangeability in manufacture. He thought detachable hot plates a good feature in electric cooking apparatus. The author's figures of cost depended on the ½d. units. He had used electric cooking for three years at 1½d. per unit, at which price it was economical to heat water. At ½d. per unit he knew the cost of electric cooking was within that for coal and gas cooking. As a rough guide to this consumption in a kitchen, he found that one unit per day per person, plus a unit or two for the cooker, was about the average.

After a few remarks by others on the Birmingham figures, the author briefly replied.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Apparatus on Hire.

I have been much interested in the series of articles by Mr. T. C. Parsons on the above that have been appearing during the past few weeks.

In last week's number Mr. Parsons describes a card that is used to keep track of the motors that are installed on hire and hire-purchase. I would suggest that the cards could be made much more useful if more information were put upon them. Motor makers do not use the same size brush for many machines, and as the principal trouble with modern motors is a worn brush, a journey may be saved if full information *re* the brushes is put upon the card. A frequent trouble is a blown fuse through bad starting, and if different types of fuses, cartridge, "Zed" or open, are used, it is worth while to have the information handy, so that the right sort can be sent, in the event of a 'phone call. Mr. Parsons mentions that he does the usual trick of "swapping" armatures when necessary; it is advisable to keep track of the maker's numbers of the armatures as well as of the frames in this event. The card enclosed is one that I devised whilst responsible for the department of a contracting firm that had many hundred motors out upon hire and hire-purchase, as well as ordinary installations, and I would suggest that any card should contain all this information. In the case of shaped brushes, the profile may be registered by inking the brush on a rubber stamp pad, and stamping the back of the card, at the same time registering the dimensions and length in millimetres.

In this week's issue, Mr. Parsons gives some figures *re* costs of room heating that are not of much service to the makers of radiant heaters. It would be very interesting to know if Mr. Parsons or any other engineer has made any similar careful practical tests comparing radiant heaters and convectors. I believe that it is acknowledged that convectors are the cheaper in running cost, and can compare better with coal or gas.

The formula quoted by Mr. Parsons

$$\text{KW.} = \frac{(30\,A + 8\,B + nC)\ 20{\cdot}4 \times t}{3{,}600 \times 1{,}000}$$

was originally published by me in a convector maker's catalogue, and I am afraid that it cannot be used for radiant heaters. It is based on the assumption that the walls derive their heat from the air in the room, and that they are at the same, or a little less, temperature than the air. Each square foot of window dissipates approximately 30 units per deg. F, and each square foot of wall surface, on the average, eight units. The formula works out pretty consistently in the case of big halls and rooms heated by convectors, but, where

Installed at .....

.....

..... B.H.P. ..... r.p.m. ..... Volts ..... Frequency

Maker .....

Frame* ..... Armature* .....

Brushes No. ..... Size .....

Pulley Diam. ..... Face .....

Driving .....

.....

Fuses ..... ◯ Supply Co. .....

Installed .....

the walls and floors, &c., are at a higher temperature than the air, as is the case when radiant heaters are employed, they naturally dissipate more heat than is indicated in this formula. I presume that radiant heat advocates will agree to this, and admit that this is why their heaters are of 3-KW. capacity or thereabouts.

G. H. Elliott.

London, W., *September 27th*, 1913.

In reply to Mr. T. C. Parsons's letter of September 19th, I may say at once that so far as the scheme he details relates purely to the hiring-out of motors, and apart from all question of municipal ownership, very few traders or manufacturers would take exception to it, especially in view of the facts now made clear, namely, that fair prices were given for motors and that a qualified and fully-paid attendant was employed to carry out the inspections.

By far the most serious objection, however, is generally in connection with the sales effected by many of these so-called municipal hiring departments, and it will be noted, taking the figures for Govan, that apparently out of 146 motors purchased by the undertaking, no fewer than 42 were sold direct to the consumers. In the only other case for which figures are given, namely, No. 6 on the list, it appears that whereas in 1912, 70 motors, representing 670 H.P., were out on hire, 308 motors, representing 2,552 H.P., had been sold outright to consumers. It would seem that where so large a proportion of the motors are being sold it is somewhat misleading to take average figures and treat these as if they referred to hiring alone. Apparently maintenance and repairs would be discontinued as soon as a sale had been effected, and many motors would be sold before they had been running sufficiently long to need much in the way of repairs; in fact, no doubt very often the motors would be sold within the period for which they were guaranteed by the makers.

Returning to the question of the injury done by direct sales, the writer has it on the best possible authority that in one city the consumers, at any rate a short time ago, could buy their motors from the Corporation at prices, roughly 10 per cent. below those at which the largest contractors in the city could buy motors of the same make. The motors, it may be said, were foreign ones, so that here the whole

matter resolved itself into a case of "dumping" pure and simple, and on a very large scale. It was really against abuse of this kind that my letter was chiefly directed.

In conclusion, with regard to the whole question of the letting out of motors on hire by municipalities, from the writer's experience it is always easy to convince anyone that electric motors are much the cheapest and most convenient form of power to install. The real trouble nowadays is in connection with the price to be paid per unit, and if Corporations wish to give something away, they should give it here, where it would be most appreciated. A consumer can usually obtain a motor on hire from a private firm if he wishes to do so; but when this is not the case, then, and then only, is there any justification for a Corporation taking up this work.

Electric Motor and Stove Hiring Co., Ltd.
H. S. Ingleby, *Secretary.*

Leeds, *September 29th*, 1913.

A Charge Engineer's Complaint.

I was rather amused at the letter in your last week's issue from a charge engineer indignant at the idea of an engine driver being made a shift engineer, but I think that it should serve rather as a warning to college men *not* to go in for central station work, as it must be admitted that non-college men, and even the raw material, can be trained to make very good station attendants. Nowadays, with reliable generating plant, highly-trained men may not be necessary, and possibly complaints like Mr. Fredericks's will fall back on the chief engineers responsible. It should be remembered that many chiefs are depending on their shift engineers and station supers. for their low works costs, the manager taking all the credit. But Councils and others are becoming better acquainted with the state of affairs, and the days of the overpaid manager may also be numbered.

I am an engineer's traveller, and have been through a great many stations and conversed with station supers., who complain about the manager taking credit for their work. The station of the future could be run with a good accountant as manager, the reports to Councils, &c., and questions of charges, being merely a good accountant's work. A manager such as this, with a good station super. and mains engineer under him, are all the hands necessary for a station up to 3,000 or 4,000 KW.; when extensions become necessary, give the vast army of consulting engineers a chance to carry them out and give them something to do; so young men, with fine college training, eschew station work and be consulting engineers.

Converter.

Permit me to comment upon Mr. James Fredericks's letter, under the heading "A Charge Engineer's Complaint," printed in the issue of September 26th.

He complains that an engine driver pure and simple has been appointed charge engineer. If it be true that the man had only sufficient abilities for a driver, he ought not to have been appointed to the higher position. But the fact that the chief gave him the post seems to show that he had qualifications which he did not make known to everybody, thus making the appointment look unfair. I would like to point out that enginemen's duties in certain stations comprise electrical and mechanical jobs, testing, and even switchboard attendance. An engineman who has had experience in the shops or erecting, previous to several years in the central station, as well as a certificate for a College course of engineering, has an equal right with any B.Sc. or University man in competing for a higher position in the central station. I do not agree with Mr. Fredericks in preventing an ambitious engineman or other young fellow from getting on.

Hundreds of pounds spent on training for a position in a central station is sheer waste, when electrical courses can be had now so reasonably. Engineers should be good practical all-round men, those who have worked up through several stations, from the boiler house upwards; and this is found in a good ambitious engineman with technical training.

Ambitious.

Your correspondent, James Fredericks, in your last issue complains that an engine driver has been promoted to shift engineer and has as colleagues a Faraday House man and a University graduate; presumably this refers to the recent appointment at the Burton-on-Trent Electricity Works. I beg to congratulate the engine driver.

Recently, a shift engineer informed me that he had resigned his position as "shift" to take up an appointment at another station as "fitter-driver" at about 30 per cent. increase in wages; this engineer had a good technical training and was (in the generally accepted meaning of the word) "qualified."

Compare the supply authorities of Coventry and Hammersmith, capacity of both stations between 9,000 and 10,000 KW. The charge engineers at Hammersmith are paid £200 per year, at Coventry anything from £85 to £117 per year.

These cases show clearly the chaotic state of employment in electrical stations. The Universities, Faraday House, Technical Colleges, Polytechnics and Correspondence Schools are all turning out hundreds of highly technically-trained men every year, whose only prospect is a mere pittance as charge engineer, while we see carpenters, bricklayers, &c., who have not had the opportunity of technical education obtaining a wage which only a minority of the technically-trained men can expect to equal as a maximum in the best-paid stations.

To remedy this miserable state of affairs, the technical man in electrical stations must have recourse to organisation, the only remedy.

I am very pleased to state that a fair proportion of station men in the United Kingdom have realised this fact, but there are others who consider it beneath their dignity to join any organisation that proposes to demand better conditions, and do not consider it beneath their dignity to work for a mere pittance and depend on someone else to keep them from starvation.

A certain class of chief engineer fosters the "beneath their dignity" idea. One can quite understand that a chief engineer would not be exactly comfortable in a well-organised station where the wages were low and the Electricity Committee refused to consider an increase.

There is another point that has prevented progress in the past. I refer to the bickerings and petty jealousies that are the rule, and not the exception amongst employés of electrical stations, and must seriously call to account all those who are responsible for this state of affairs, because if they do not sink their petty differences and suspicion of the other man, and uphold a spirit of mutual help, they can never hope to better their conditions financially or otherwise.

In conclusion, I must emphatically point out that the main cause of the miserable conditions in electrical stations cannot be blamed to premium pupils, chief engineers, electricity committees, or company directors, but to the employé who remains outside his organisation.

W. J. Ebben,
Hon. Secretary, A.E.(S.)E.

Stratford, *September 30th*, 1913.

Birds and Railway Accidents.

While waiting at a wayside station the other day, I observed some pigeons sitting on a wire leading from a signal cabin to a route of telegraph poles. When the birds flew away together, the upward bound which they gave at the commencement of their flight caused the wire on which they had been sitting to swing into contact with some of the telegraph lines. I was curious to know what effect in the signal cabin would be caused thereby. On inquiring I found that a stray current had entered the apparatus there, and that a false indication had been produced, giving the signalman authority to send a second train into a section which was already occupied. Pursuing my inquiries, I was astonished to learn that many railway instruments are liable to similar interference.

Traveller.

Municipal Tramways Conference.

In your current issue you make the following remark regarding Mr. Hamilton's paper, on "Urban Passenger Transport." "The spectacle of Mr. Hamilton solemnly proving that 'bus costs cannot be under 10d. per mile, and will inevitably increase, when brother managers are experimenting right and left and buying still more 'buses, is rather humorous." As a constant reader of your journal this appears to me a very unfair comment.

None of the "brother managers" to whom you refer operate 'buses at less than 10d. per mile, and, personally, I do not think anyone (with the possible exception of Mr. Fearnley) operates municipal 'buses at so low a figure as this. The figures given for Keighley, Halifax and Eastbourne are 16d., 12·7d. and 14·39d. per mile respectively.

Mr. Hamilton's figures were not challenged at Sheffield. Even Mr. Worby Beaumont had nothing to say on Mr. Hamilton's calculation for 27 towns in Great Britain (with over 150,000 inhabitants each) where municipal tramways are operated.

The author of the paper stated that instead of those towns getting, as at present, a profit in receipts and other services to the towns of £1,642,356, there would be a loss of £2,556,441, if, on the present available figures, tramways were superseded by motor-'buses.

Turning to your remark again, however, I see no reason why a large municipality should not experiment with motor-'buses even if they cost 1s. per mile to operate, if the chief object of the experiment is to test the traffic possibilities of a particular suburb before incurring heavy capital expenditure for tramway track.

Urban passenger transport of the future will be a question of the survival of the fittest, and Mr. Hamilton has proved conclusively that the fittest form at present is by means of a steel wheel on a steel rail, and that if the municipalities have the best interests of their ratepayers at heart, the tramway must be used in preference to the motor-'bus, on account of the lower operating costs, to say nothing of the much greater street dangers involved by the use of the motor-'bus.

L. C. F. Bellamy,
Borough Electrical Engineer and Tramways Manager.

Ilkeston, *September 29th*, 1913.

[Mr. Bellamy takes the remark in our brief report too seriously; as a constant reader of our pages, he must be aware that our views are quite in accord with those which he outlines. We have always held that while the motor-'bus is useful to tramway managers for experimental purposes, and as a feeder to the tramways, it cannot deal with heavy traffic in fair competition with the latter. We had no intention of ridiculing Mr. Hamilton's paper, and regret that the remark was made, though the situation still appears to us to possess a humorous aspect.—Eds. Elec. Rev.]

The "Hand" of an Armature.

Your correspondent, Mr. Moores, says that it is unlikely that uniformity will ever be reached in the nomenclature relating to the "hand" of an armature, and gives as his reason that my suggestions differ from the existing standard practice of several leading manufacturers in this country. His next sentence leads one to believe that the standard practice referred to is not a question of nomenclature at all, but of actual windings. I am well aware that some firms build their armatures right-handed and some left-handed, and I have not set out to persuade every manufacturer to build armatures of the same hand. In my article I have given what I believe to be a practical definition of right and left-handing applicable to all drum armatures, and have pointed out where the two hands differ. The classification appears to me to be a natural one, and I think it is likely to be followed. This, however, as you suggest, is a matter for the Electrotechnical Commission. I have yet to find the text-books that "support my suggestions," as Mr. Moores kindly puts it, and I would be grateful if he can enlighten me.

Humphry MacCallum.

Chelmsford, *September 29th*, 1913.

Electric Vehicles.

In your leading article on the above subject last week, you seem to lay the whole onus of the development of electric vehicles on the central station engineer, and perhaps it would be interesting to you to hear my experience in attempting to get some information on the subject.

I may say that at the present time I am running some 20 vehicles for the transportation of goods and passengers, a considerable portion of their work consisting of journeys under 20 miles. I am also running a power station plant which is turning out current at about ·25d. per unit, and was under the impression that I was in an exceptionally sound position to take up electric vehicles.

On May 30th this year I made a preliminary inquiry of a firm selling vehicles in this country as to whether they had any 4 or 5-ton vehicles yet running, and received their reply on June 10th to the effect that they had not such heavy types running in this country, but in a few days they were giving a demonstration in this town with a ½-ton vehicle, and would be pleased to bring this car down to our works. I then replied on June 11th to the effect that I should be interested to see the half-tonner when down here, and should like to have full details with cost of running, &c., of a five-tonner, and to arrange, if possible, a trial of such a vehicle under actual working conditions, the cost of which we were prepared to pay.

I also obtained a quotation for a small battery set to run on one of our petrol lorries, so as to judge how they would stand our local roads, which are exceptionally bad. This was obtained, order placed and battery received, and has since been working. I have since twice written them for details of the five-tonner, and also when the half-tonner would be down here, but so far without result. My object in writing this is to show you that the station engineer can never get a vehicle load unless the manufacturers pursue a more business-like method of putting their vehicles before prospective customers.

Chief Engineer.

[Our correspondent's experience is unfortunate; apparently he dealt with only one firm, which had not sufficiently developed its organisation to supply his needs. We have reliable and independent information which indicates that, now that the central-station engineers are moving in the direction of providing charging facilities, manufacturers are taking steps to do their part.—Eds. Elec. Rev.]

Safety of the Diesel Engine.

I read a paragraph in the Electrical Review last week, referring to the accident at Bray, due to the bursting of the blast bottle, previously filled with oxygen, of a Diesel engine. Being one of those who regard this type of engine, relative to other prime movers, somewhat in the same way as electric light *versus* gas, and wishing to see it dealt with in the fairest way, I should like to ask whether it cannot be definitely stated that if oxygen had not been used no accident would have occurred.

I do not go so far as to advocate that a non-return valve on the blast-pipe is unnecessary, but certainly think that a far more necessary appliance would be a relief valve on each cylinder. This would allow abnormal pressures to escape, but more especially it would provide for the escape of water when starting up, should an excessive quantity have leaked into the cylinder from the cooling water jacket whilst the engine was shut down.

P. F. R.

[A lengthy abstract of the Home Office Report on this matter appears elsewhere in this issue.—Eds. Elec. Rev.]

A.E.(S.)E.

As one who was present at the last general meeting, I was exceedingly surprised at the large number of members of the Electrical Trade Union who had congregated for the specific purpose of informing the central-station men of the extent of their beastly "Snobbishness." As I understood the A.E.(S.)E. was formed for this so-called "Snob" class, I

sincerely hope they will maintain the distinction. I feel confident after conversation with several central-station men that many meetings of this description will see the downfall of a promising Association.

Snob.

Metalite, Ltd.—We have received from Mr. F. Harrison, of 14, Dickenson Road, Crouch Hill, London, N., a somewhat lengthy letter replying to the questions put by "A Northern Shareholder" in our issue of September 19th. We regret, however, that owing to the demands upon our space, and to the limited interest of a number of the points covered, we are unable to publish the communication. We would suggest that those who desire further information should get into touch with Mr. Harrison.—Eds. Elec. Rev.

THE EXPLOSION AT BRAY U.D.C. ELECTRICITY WORKS.

The following is an abstract of the report of Mr. G. S. Taylor, H.M. Inspector of Factories, on the circumstances attending the explosion which occurred at the electricity generating station of the Urban District Council of Bray, Ireland, on July 10th, 1912 :—

This explosion caused the destruction of a steel storage vessel for compressed air used in connection with a Diesel oil engine, resulted in the death of Christopher Coates, the head fitter at the station, and caused such injuries to Mr. W. J. Sowter, the chief engineer, that both legs had to be amputated. Mr. McDonnell, the assistant engineer, also sustained extensive burns and other injuries to his face.

The engine at Bray was constructed by Messrs. Mirrlees, Bickerton & Day, Ltd.; it had a single cylinder 12 in. diameter, worked on a four-stroke cycle, developed about 50 H.P., and was first started in March, 1910. Compressed air for fuel ignition and starting purposes was obtained from a two-stage air compressor driven directly from the main engine shaft. An inter-cooler was provided for cooling the air between the two stages of compression, and the air passed through another cooler after the final compression. From this after-cooler the compressed air, at a pressure approaching 900 lb. per sq. in., passed through a ½-in. copper pipe into the blast air vessel. Compressed air from the blast vessel was conveyed to the fuel valve by a blast injection pipe of solid drawn copper ½-in. diameter, ¼-in. bore and about 16 ft. in length. The blast air vessel consisted of a lap-welded mild steel cylinder 3 ft. in length, 8 in. external diameter and $\frac{13}{32}$ in. in thickness; circular plugs 1⅛ in. in thickness were welded into the ends, the upper plug having a hole communicating with the entrances to the valves in the steel "head." The "head" was fitted with a spring-loaded safety valve $\frac{3}{16}$-in. diameter set to blow off at a pressure of 1,050 lb. per sq. in. A ⅜-in. copper pipe with an open and bevelled end extended almost to the bottom of the blast vessel; this pipe acted as a drain for any condensed water, and also conveyed the compressed air to the starting air vessels. There were two such vessels of mild steel with a longitudinal lap-weld and welded ends, of the following dimensions :—Length, 6 ft.; external diameter, 14¾ in.; thickness, ¾ in. They were fitted with steel "heads" connected by a T-piece, the vertical branch of which communicated with the starting valve on the engine cylinder. The interiors of these three air vessels had been coated with a bituminous composition to prevent corrosion.

On Sunday morning, July 7th, the Diesel engine was stopped by the engine attendant, and about 6 p.m. on the same day, when the station was visited by Mr. McDonnell, the assistant engineer, the attendant drew his attention to the loss of air from the three air vessels. At this time the gauges indicated a zero pressure in the reserve starting air vessel, and pressures of 350 lb. per sq. in. in the other starting vessel and in the blast vessel. On Monday, July 8th, the Diesel engine was overhauled, the fuel, exhaust and air valves were taken out, reground and replaced; the atomiser was cleaned, and the clearances on the valves were set by Mr. McDonnell. It was impossible to start the engine with an air pressure of only 350 lb. per sq. in. in the blast vessel, as this would be insufficient to inject the fuel oil into the cylinder. It was impracticable to use the Diesel alternator as a motor, and thus drive the engine and compressor until the necessary air pressure had been obtained in the blast vessel. In the absence of an auxiliary compressor, the pressure in the blast vessel had to be raised by other external means. A printed copy of instructions, supplied by the makers of the engine, contained the following statement :—

"If by any mishap the air is lost and no compressor is available, or if the engine cannot be run by external means so as to charge the receivers by its own air compressor, then these may be charged with carbonic acid gas or oxygen from the cylinders containing these gases, as used for many purposes."

As compressed oxygen had been so used without accident when the air pressure was lost in the previous February, a cylinder of compressed oxygen was ordered by Mr. Sowter from a firm of Dublin chemists, which was delivered at the factory on the morning of Wednesday, July 10th. Oxygen cylinders are usually charged with gas at a pressure of 1,800 lb. per sq. in. Shortly after its arrival the oxygen cylinder was coupled to the compressor connection of the blast vessel and the pressure was raised to 800 lb. per sq. in. The supply of oxygen was temporarily stopped and the valve opened between the blast vessel and the starting vessel; compressed air and oxygen thus passed over into the latter vessel, but the pressure in this was only slightly raised above 350 lb. per sq. in., as the pressure in the blast vessel fell from 800 lb. to 750 lb. per sq. in. The volume of the starting vessel was about nine times the volume of the blast vessel. The valve between the vessels was closed, and the oxygen again turned on to the blast vessel, until the pressure within was raised to 800 lb. per sq. in.; the oxygen cylinder was then removed and the high-pressure air delivery pipe from the compressor reconnected to the blast vessel.

The ordinary fuel (crude oil) was then emptied from the fuel pump, and from the engine fuel supply pipe, which was temporarily disconnected from the fuel valve. The fuel pump and pipe were then charged with ordinary lamp oil (kerosene), and when the fuel valve connection had been made, several strokes by hand were made with the pump, so that the atomiser in the fuel valve casing was charged with kerosene. The crude oil was then turned on from the supply tank, and the starting lever on the engine placed in the "starting" position. Mr. McDonnell stated that he then opened the valves in the following order: (1) Valve from blast vessel to fuel valve; (2) valve from compressor to blast vessel; (3) valve between blast vessel and pressure gauge; and (4) starting valve on starting air vessel. The engine began to move, and after the starting valve was fully opened, seemed to run quite satisfactorily. Mr. McDonnell therefore went to the engine platform and put the starting lever over from the "starting" to the "running" position. No firing stroke occurred, but air could be heard escaping from one of the valves with a hissing noise. The fitter Coates was at this moment standing on the far side of the engine, with his hand on the air intake pipe which is connected to the air valve on the engine cylinder. Coates made some remark apparently about the escape of air, but Mr. McDonnell did not hear this distinctly; Coates then moved to the other side of the engine, and at this instant an explosion occurred at the fuel valve on the cylinder, a blue flame was seen to travel along the blast pipe to the blast vessel, and the latter exploded with great violence. Mr. Sowter was standing on a concrete platform about 1 ft. 6 in. above the floor level close to the blast vessel which exploded, and was struck on the legs by flying metal. Probably the same fragment struck Coates, who was on the floor level, in the abdomen, causing his death within a few minutes. Mr. McDonnell was standing on the engine platform and sustained burns to his hands and face as a result of the fuel valve explosion. In addition to these personal injuries, the explosion and flying portions of the blast vessel caused considerable damage to the building and plant.

The upper part of the fuel valve cover was found on the platform near the engine cylinder; it showed no signs of having been violently projected, but was fractured across the webs below the spring box. The lower part of the cover was fractured on one side close to the gland and inside a stud hole. The top of the fuel valve casing which was outside the cylinder cover had a piece broken out on the same side as the fracture in the lower part of the casing cover. The fuel valve needle was in position in the casing and only slightly bent. The perforated washers forming the atomiser were in position around the needle, and had a slight carbonaceous deposit on them.

The air inlet and exhaust valves in the cylinder cover were both found to be leaky, and apparently at least one of these was in this condition prior to the explosion. Neither of the valves had been damaged, and the exhaust passage was coated with the usual sooty deposit.

The air starting valve was found in order, but it is not clear whether the hand lever was left in the "starting" or in the "running" position. Mr. McDonnell is certain that he put the lever into the "running" position, and thinks that he probably pulled it back involuntarily at the moment of the explosion in the fuel valve casing when he jumped from the engine platform. The engine cylinder cover was quite intact and the bolts showed no signs of injury. The blast injection pipe was burst in three places; the pipe had been opened up and flattened over lengths from 8 in. to 10 in., and the metal at the edges of these fractures was reduced to the thickness of a piece of paper. The interior of the pipe was coated with a more or less oily deposit.

The blast vessel was blown into eight fragments, and both the top and bottom plugs were completely separated from the cylindrical body of the vessel. The steel head with the valves remained attached to the top plug, and the holding-down studs had not been injured. The welding between the top plug and vessel was defective for about three-fourths of the circumference. The welding of the bottom plug was good, and the metal had been torn from the weld near the inside edge of the plug. The fragments of the body are of various shapes, and showed that the material at the longitudinal weld was practically as strong as the other parts. The fragments show signs of stretching, and as part of one piece had been bent double without indications of cracking, the steel appears to have been of good average quality and ductility. The interior surfaces of the fragments forming the centre of the vessel were blued, showing subjection to a high temperature, but the action of heat was less marked towards the ends of the vessel and on the plugs. No evidence of corrosion, either external or internal, was noticed, but the whole of the internal coating of anti-corrosive paint, with the exception of a slight trace, had been removed, probably by the explosion. There were indications that the valve had operated during the explosion, but a valve $\frac{3}{16}$ in. diameter would offer little relief for an explosive pressure. The internal pipe of the blast vessel had been burst in two pieces in a somewhat similar manner

to the blast pipe. The air compressor and air coolers were uninjured and in order.

Tests have not been made upon the material of the blast vessel, as there was no reason to doubt its suitability. Assuming this mild steel had an ultimate tensile stress of 30 tons per sq. in., and allowing 30 per cent. reduction in strength for the welding, a pressure of at least 5,320 lb. per sq. in. would be necessary to rupture the blast vessel.

Such pressure might be produced in a vessel containing a gaseous mixture: (1) by rise of temperature due to addition of heat from some external source; (2) by rise of temperature due to injection of a mass of highly heated gas; (3) by transmission of an explosive pressure wave from some connected vessel; or (4) by rise of temperature and increase in the gaseous contents due to ignition of some combustible material within.

Previous to the explosion, the blast vessel contained a mixture of pure oxygen and air in the proportion of about 3 vols. of oxygen to 2 vols. of air, equivalent to about 68 per cent. of oxygen. The gaseous mixture was at a pressure of 800 lb. per sq. in., and at a temperature of about 70° F. (the temperature of the engine house). In order to produce a pressure of over 5,000 lb. per sq. in., the gaseous mixture would have to be raised to a temperature approaching white heat. There is, however, no evidence of the proximity of any external source of heat which would produce such a temperature.

The second cause appears to be equally unlikely.

Dealing with the third possible cause, the blast vessel was connected to two sources from which an explosive wave might be propagated—viz., (1) the high-pressure air delivery pipe from the air compressor, and (2) the blast pipe from the fuel valve casing. An explosion originating in the pipe or in the compressor, which could produce sufficient pressure to burst the blast vessel, would have caused fractures in these parts. The absence of damage indicates that the explosion did not originate in them.

Any explosion in the engine cylinder which could transmit a wave of sufficient pressure to burst the blast vessel would, in all probability, have caused more damage to the cylinder and attached parts than was actually found.

The fragments of the blast vessel, especially those from near its central section, bore signs of local heating, and the bituminous lining appeared to have been burnt off. The fragments were not much reduced near the edges of the fractures, though there were indications that the material was sufficiently ductile to have shown, under a steadily increasing pressure, considerable thinning before fracture. It may, therefore, be concluded that an explosion occurred within the vessel, and developed with such rapidity that an instantaneous pressure was produced, causing a stress in the walls beyond the ultimate strength of the material. The fractures in the blast pipe and internal drain pipe indicated violent but localised explosions. There is evidence that these were preceded by an explosion, which was more or less localised in the fuel valve casing.

Under ordinary conditions of working, the blast vessel contains an oily emulsion in addition to compressed air. This emulsion is a mixture of water, from the moisture in atmospheric air, and traces of lubricating oil from the air compressor cylinder. Though much of the water and oil is removed by drains on the air coolers of the compressing plant, appreciable quantities of these pass over as vapours into the blast vessel and are there condensed. In the case of the engine at Bray, the oily emulsion was blown periodically from the blast vessel into the starting vessel, from which it was drained at intervals. In course of time the interior of the vessels becomes coated with oily matter. There is definite proof of oily deposits within blast vessels and similar compressed air cylinders. The blast vessel at Bray had been in use over two years, and the interior had never been scraped or otherwise cleaned. Many explosions and failures of air receivers, used in connection with compressed-air plant for mines, factories, and other works, have been traced to ignition of lubricating oil or vapour carried over into the receivers. The interior of the Bray blast vessel had been coated with bituminous composition which would also provide some amount of combustible matter. Moreover, since the engine had been standing for a few days previous to the explosion, it is improbable that any vapour of lubricating oil was present in the blast vessel, especially as the lubricating oil had a flash point between 425° and 450° F.

Some of the oily deposit probably was vaporised and ignited by injection of heated air or vapour into the blast vessel. It could enter the blast vessel by means of the blast or air injection pipe. Before the engine was started, this blast pipe would be filled by the blast vessel with a rich oxygen mixture which would be in contact with the kerosene in the fuel-valve casing. The flash point of ordinary kerosenes is between 70° and 90° F., and it is conceivable that kerosene vapour might have diffused into the oxygen mixture in the casing and blast-pipe. The kerosene, or its vapour, might have been ignited in several ways, but it is difficult to say what actually occurred. When the fuel-valve was opened, the kerosene in the casing may have been ignited by a flash back from the cylinder; a case is known in which this occurred with ordinary air injection, owing to the fuel-valve sticking up, and a considerable length of the blast-pipe was burst open. Again, kerosene would ignite at a lower temperature in compressed oxygen than in air, and it is possible that it might have been detonated in the oxygen mixture by the fuel-valve coming down on to its seat. Further, Sir Boverton Redwood has demonstrated that kerosene (F.P. 79° F.), if finely sprayed by pressure through a leaky rivet-hole, formed a mist which readily ignited at a temperature of 50° F. Therefore, if any obstruction was present in the fuel oil orifice in the valve casing, the mere spraying of kerosene into the oxygen mixture might have produced ignition.

Whatever the cause of ignition, and whether it originated from the cylinder or the fuel-valve casing, the evidence is clear that an explosion occurred in the casing. After the accident the blast-pipe showed on its interior surface traces of oil, possibly carried over from the blast vessel, or due to creeping of fuel oil along the pipe, or accidental injection in operating the fuel pump by hand. The explosion in the valve casing probably vaporised some kerosene which would propagate an ignition along the blast pipe and set up violent local explosions which burst the pipe, producing the effect observed of a flame travelling along the pipe. The flame would travel to the blast vessel, raise the temperature sufficiently to vaporise and ignite the oily deposit and the bituminous lining, which in the presence of excess of oxygen produced a violent explosion. The blast vessel probably contained some condensed water, and as water vapour would be present both in the vessel and piping, this may have accelerated the velocity of explosion and even added to its intensity. Dixon has shown that gaseous mixtures which cannot be exploded when perfectly dry, will do so readily when a trace of water vapour is introduced, and that the velocity of the explosion is enormously increased by the presence of water vapour. The fact that the oxygen mixture in the blast vessel and blast pipe was at a pressure of 800 lb. per sq. in. would not affect the propagation of an explosion from the valve casing, for Berthelot has shown that the velocity of transmission of explosions is independent of the pressure, the diameter of the tubes containing the explosive gaseous mixture, and also of the material composing the tubes.

There is no doubt that the presence of more than three times the normal amount of oxygen in the blast vessel added greatly to the violence of the explosion, and also facilitated the transmission of the explosion from the fuel valve, if it did not actually cause the initial explosion in the fuel valve casing. But it seems also clear that an explosion of the blast vessel would not have occurred if the walls of the vessel had been free from oily deposit. How far the anti-corrosive lining added to the effect it is impossible to say.

Cylinders of compressed air (pressure 1,800 lb. per sq. in.) can be obtained from the gas-compressing firms in London and some of the large provincial cities. Such cylinders have been utilised on several occasions for the purpose of recharging the air vessels of Diesel engines. But these facilities do not appear to be generally known, and so far as can be ascertained this method of recharging is not specifically mentioned in the instructions issued by any of the British or Continental makers of Diesel engines.

Compressed oxygen is not only unsuitable for recharging the air vessels of Diesel engines, but its use is obviously dangerous. Nevertheless, some firms of Diesel engine makers have issued instructions that compressed oxygen may be used for recharging purposes, as cylinders of this gas are easily obtainable.

As the result of inquiry it has been ascertained that at least two explosions of the blast vessels of Diesel engines have occurred on the Continent, owing to the use of compressed oxygen for recharging.

Many explosions and failures of air receivers connected with air-compressing plants have been recorded in the past, which have been traced to the presence of lubricating oil in these receivers. As the result of inquiry, it has also been found that similar explosions have occurred in the pipes and air vessels of Diesel engines. Mineral lubricating oils with high flash points should always be used in the cylinders of air compressors.

In addition to explosions from ignition of oil vapour, explosions of the high-pressure air cooler casings have occurred, and some of these have caused personal injuries. The compressed air, and possibly also the particles of solid matter which it contains, appear to exercise a scouring action on the interior of the pipes, especially in the neighbourhood of bends. After a time the pipes may be reduced in thickness to such an extent that they are unable to withstand the pressure of 650 to 900 lb. per sq. in. to which they are subjected, and therefore burst. An ordinary spring-loaded safety valve is quite inadequate to relieve the sudden pressure exerted, and other safeguards should be provided, *e.g.*, thin diaphragms of metal or other material which readily rupture with excessive pressure.

The inquiry leads to the following conclusions:—

1. The explosion of the blast vessel was caused by the ignition of an oily deposit on its interior.

2. Ignition was transmitted by a flame explosion from the fuel valve casing passing along the blast pipe, but there is no evidence to show whether this ignition originated in the fuel valve casing or was transmitted from the engine cylinder.

3. Ignition was facilitated, and the resultant explosions were intensified, by the large volume of compressed oxygen contained in the blast vessel and blast pipe.

4. This compressed oxygen had been used in the blast vessel in order to raise the pressure sufficiently to start the engine, and was so used in accordance with the printed instructions issued by the makers of the engines

5. Owing to the presence of deposits of lubricating oil carried over from the compressors, the same danger of ignition and explosion exists in blast vessels of Diesel engines as in the air receivers of air-compressing plants.

6. There are considerable practical difficulties which prevent the removal of all the lubricating oil vapour from compressed air before it enters the blast vessels, although entire removal is very desirable.

7. "Back fires" or explosions are sometimes transmitted from the cylinders of Diesel engines to the fuel valve casings and blast pipes; and ignitions, sometimes accompanied by explosions, occur in the high-pressure air delivery pipes of the compressors.

8. Loss of air pressure from the blast and starting air vessels of the Diesel engines occurs more frequently than the engine makers admit. This loss is often due to carelessness, but sometimes is due to the inexperience of the engine attendant.

Recommendations.—It is suggested that the observance of the following recommendations would tend to reduce the risk of explosions and accidents in connection with the running of Diesel oil engines.

1. Compressed oxygen, on account of its intense chemical affinity, and combustible gases like hydrogen, should not be used for the purpose of re-charging air vessels, and a warning to this effect should be issued by the makers of Diesel engines.

2. Definite instructions should be issued by the makers with regard to the adoption of safe methods for re-charging air vessels.

3. Only competent engineers, or experienced men under the direct supervision of a qualified engineer, should be employed as engine attendants on Diesel plants.

4. Traces of oil or oil vapours should be removed as far as practicable from the compressed air before it passes into the blast vessel.

5. Air vessels, especially blast vessels, should be cleaned and examined internally as far as practicable once every 12 months; they should also be tested hydraulically once in every four years, and the amount of expansion of the vessel under the test pressure should be carefully gauged.

6. Some device should be fitted for preventing the transmission of flame explosions along the compressed-air pipes.

An appendix gives particulars of 19 explosions in connection with Diesel oil engines, of which nine cases were due to the compressed air-pipes, and six to the blast injection pipe or the blast vessel exploding.

The complete report [cd. 6.964] can be had from Messrs. Wyman and Sons, Ltd., Fetter Lane, E.C., price 5d.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Redglo" Electric Fires.

Messrs. Redglo, Ltd., of Royal Liver Building, Liverpool, are supplying the "Redglo" electric fires in a number of interesting and attractive styles, and these are illustrated in the new catalogue that they have just issued. Several of the designs shown are specially suited for use as fire screens, the appearance being enhanced by the globe in the centre. Others are specially adapted for domestic use. It is claimed for the system that it gives a red-hot fire. The heating element is entirely covered in by a quartz dome with an area of 23 sq. in., and from the globular face the red rays of heat radiate.

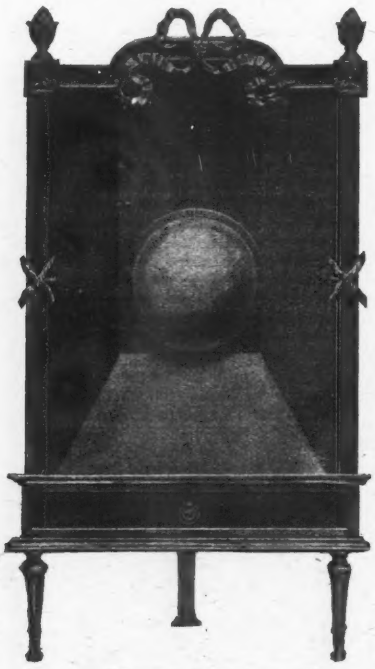


Fig. 1.—"Redglo" Electric Fire.

Beneath this dome is disposed the actual heating medium or element, the alloy for which is warranted to withstand for very long periods the high temperature at which it is necessarily worked, even in the atmosphere which contains gases, which in time would prove detrimental to its life. In order to increase the life, the surrounding medium is arranged so that as far as possible it shall be neutral in its effect upon the alloy. The heater element is disposed upon a base which is also neutral in its effect upon the special alloy used, and at considerable extra expense this special alloy is used for all parts in proximity to the heat centre. Substantial leading-in pillars are formed of the same and carried right out and screwed into the terminals. The terminals and porcelain housings are of substantial design, roomy and far removed from the heating element and prevent the flexible wires getting overheated and breaking off short. The terminals are ample in design for 100 volts, and yet are suitably insulated and protected for use on 500 volts. The fires are wound for any pressure between 100 volts and 250 volts inclusive.

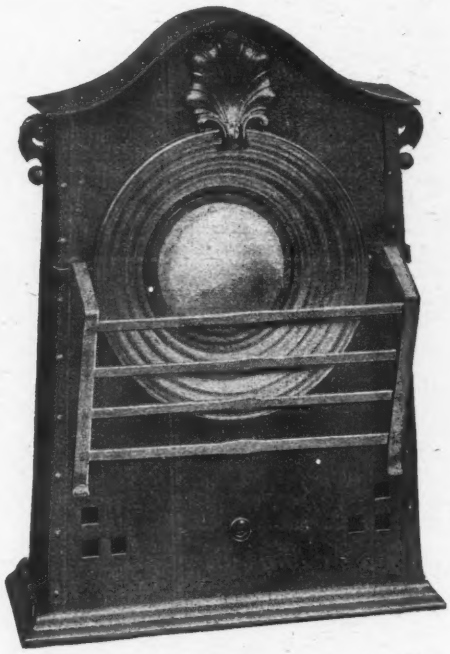


Fig. 2.—"Redglo" Fire with Adjustable Hob.

We illustrate herewith a couple of typical views of the "Redglo" radiators. Fig. 1 is the pattern No. 016 fire which is supplied in either polished brass or oxidised silver finish. In fig. 2 we show pattern No. 014 fire fitted with an adjustable hob for carrying a kettle, &c. The finish in this case is Georgian bronze and armour bright. Other examples appearing in the catalogue are finished in wrought-iron and antique copper, satin brass, antique brass, &c.

Night Bell Signal.

When commercial travellers and others arrived during the night at the Green Dragon Hotel, Hereford, they used, naturally enough, to pull the porter's night bell, but being unable to hear it ring in this official's bedroom, they were not sure whether their pulling tactics had been successful or otherwise. The consequence was that a series of noisy "ringings" was indulged in before the night porter could rise from his bed and get to the main entrance; moreover, other residents in the hotel thereby had their slumbers disturbed. So the ingenious proprietor had the word "Coming" painted in white letters on a red glass disk, which was fixed close beside the bell pull. Immediately behind this an electric light bulb was placed, the wires being carried direct to the night porter's bed room. Now, the moment a nocturnal visitor arrives and touches the bell, the night porter switches on the light which causes the word "Coming" to show up quite prominently—almost before the last tinkle of the bell has died away—and thus curbs the impatience of the newcomer.

Fig. 3.—Answering Signal for Night Bell.

Self-Contained House Service Unit with "Zed" Fuses.

Messrs. Siemens Bros. Dynamo Works, Ltd., of Caxton House, Westminster, have devised a new "Zed" house service in which the supply authorities' meter and fuses are mounted in a compact cast-iron case, provided at the bottom with terminals for connecting the supply and house mains respectively; all other connections are made permanently. This combination would not be possible in such a compact manner without the use of the latest pattern of "Zed" fuse fitting, in which all the metal parts are solid machined castings. For localities where utterly unskilled labour has to be employed for putting in house services, this self-contained unit should be invaluable, as it is practically impossible to make the connections wrongly. A further advantage is the saving of time in fixing, since only two screws are needed to support the iron case. The cast-iron box is provided with glazed "eyes" for inspecting the fuses and reading the meter. Space is allowed inside the case for storing several replacement fuse cartridges. The capacity of this particular box is

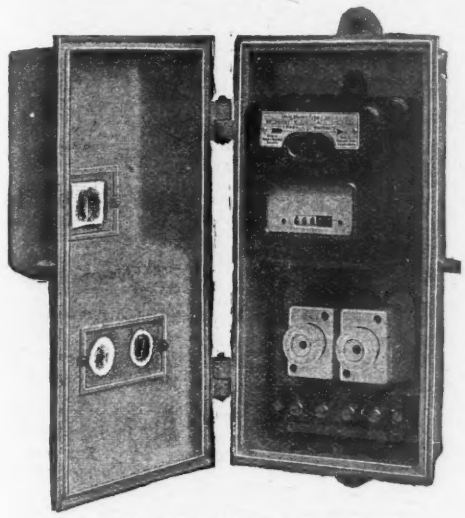


Fig. 4.—New "Zed" House Service Set.

from 2 to 50 amperes, up to 500 volts. Needless to say, the units can be supplied with or without the meter fitted.

The large number of supply authorities throughout the world who have standardised "Zed" fuses bears witness to the increased efficiency which they give in comparison with the bare-wire type of fuse. This increased efficiency shows itself in various ways; in very scattered areas it is often due to the possibility of allowing the consumer himself to replace the company's fuse when blown; in other cases, it is due to the more reliable protection of the mains and to the convenience of utilising unskilled labour to replace fuses quickly and with complete safety.

New Counterweight Fittings.

Messrs. J. M. Doughty & Sons, Ltd., of 214, St. John Street, Clerkenwell, have introduced the "Perfection" counterweight, in

Fig. 5.—"Perfection" One-piece Counterweight.

which the brass body is cast in one piece with the crutch for the pulley, making a most substantial piece of work. The strong cord guide is placed at the centre, as shown in fig. 5, and is screwed and brazed to the body: the guide and 2-in. pulley are designed to carry heavy C.M.A., or other flexible, comfortably. There is nothing loose, nothing that can possibly get out of order, and where reliability is of importance, nothing could be more suitable.

Another design, less expensive, is shown in fig. 6, the "Council"

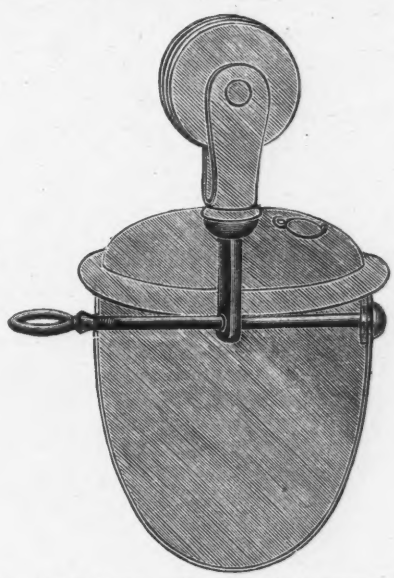


Fig. 6.—Ghost View of "Council" Counterweight.

counterweight (so called because used by the L.C.C.). In this case the body and cover are made of stout spinnings, which are held together by a bolt passing horizontally through both thicknesses of metal, and through the stem of the pulley fork, and secured by the wire guide. It is impossible for the counterweight to come to pieces, owing to the ingenious interlocking, completed by the flexible. Each of these devices can be filled to weigh 4½ lb.

Flexible Coupling.

The Standard Engineering Association, of 76, Gladsmuir Road, London, N., has introduced a flexible coupling which has many advantages in connection with the driving of or with electrical machinery. It consists essentially of packets or bundles of thin steel leaves secured in suitable holders, as shown in fig. 7. It will be noticed that in addition to the tangential flexibility due to the elasticity of the leaves, which operates equally well in either direction of rotation, radial motion and end-play are provided for by means of slots in the ends of the bundles, which also compensate for faults in alignment of the shafts, as shown in the illustrations. The leaves are held by pins fixed in cast-iron holders, which are housed in holes in the half-couplings and secured in place by spring rings which engage in grooves in the ends of the holders, so that it is a very simple matter to assemble

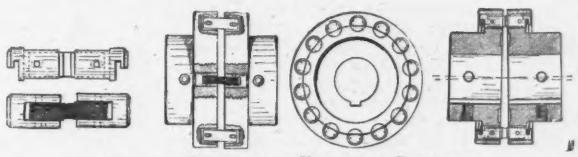


Fig. 7.—Details of Flexible Coupling.

or take apart the coupling; there are no projecting parts liable to catch in workmen's clothes.

The provision for end play enables the armatures of motors or generators to take up their position freely in the centre of the magnetic field, preventing pressure and friction on the bearings, and the use of large combined bedplates is not essential when these couplings are employed. For driving alternators with internal-combustion engines the coupling has special advantages, as it enables the machines to run in step without heavy circulating currents in spite of the slight irregularity of the speed of the engine; a similar advantage is gained in driving small lighting dynamos from oil engines, the fluctuation of voltage being eliminated. The couplings are made in all sizes up to 20 in. diameter.

Railway Battery Cars.—A new storage battery car and trailer, which are intended for the Munster district, have just been tested on the Berlin City railway. A speed of 40 miles per hour is reported to have been obtained over a length of 64 miles. The weight of the train without passengers is 84 tons, and accommodation is provided for 118 persons, whilst a separate compartment is available for mails and luggage.

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BUSINESS NOTES.

Boving Contracts.—Among the principal orders received by Messrs. Boving & Co., Ltd., up to the end of August, are the following :—

Egyptian Government at Atbara.—One pump, 330 g.p.m., 191 ft. head.
McIlwraith, McEacharn for Penang.—One pump each, 1,670 g.p.m., 175 ft. head, and 2,300 g.p.m., 175 ft. head.
Bresels Tin Mining Co., Tasmania.—One pump, 1,200 g.p.m., 100 ft. head.
S. Pearson & Son, London.—One pump, 1,000 g.p.m., 65 ft. head (third repeat order); two pumps, 278 g.p.m., 30 ft. head.
Town of Ladybank.—One pump, 200 g.p.m., 75 ft. head.
Key Engineering Co., East Africa.—One pump each, 8,000 g.p.m., 20 ft. head, and 14,500 g.p.m., 64 ft. head.
Fairrie & Co., Liverpool.—One pump, 25,000 g.p.m., 370 ft. head.

The firm have also received orders from Messrs. Mitsui & Co. for a complete paper-making plant for Odomari, Japan; from the municipality of Cape Town for 500 lapwelded tubular steel poles, 35 ft. high; and from the township of Kopjes, South Africa, for 7 miles of steel piping of various diameters. Several small turbines, including :—

Rincon Mines, Mexico.—One turbine, 750 h.p., under 55 metres head.
Messrs. Malmquist, Tucuman, Argentina.—One turbine, 94 h.p., under 64 meters head.
Bresels Tin Mining Co., Tasmania.—One turbine, 70 b.h.p., under 360 ft. head.
Hydro-Electric Commission of Canada.—Two turbines, 750 h.p., under a head of 12 ft.

The two turbines for the last-mentioned body will be manufactured at the works recently established by the firm at Lindsay, Ontario,

There is a growing tendency on the part of British manufacturers to establish works in Canada. In some cases the majority of the parts of machines are imported, and only the heavy portions actually turned out in Canada, but in several instances works have been established for the entire manufacture. Messrs. Boving & Co., Ltd., have for the past six months been located at Lindsay, Ontario, where Boving and Co., of Canada, Ltd., have taken over the works of the Madison Williams Manufacturing Co., Ltd. The existing works are small, and only employ some 30 hands, but six acres of additional land have been purchased, and extensions will be proceeded with at the earliest possible moment. The company will be manufacturing water turbines, centrifugal pumps and pulp and paper-making machinery, and, no doubt, they will find a very wide market, as they have many good examples of their design to show in Canada, notably, water turbines supplied to Winnipeg City, the Calgary Power Co., the Ocean Falls Pulp Co., the Midland Construction Co., &c., and pumps supplied to Toronto City, Montreal Water and Power Co., the E.B. Eddy Co., Nipissing Mining Co., and many others. The Lindsay works are now engaged upon two turbines for the Hydro-Electric Commission at Wasdell Falls, each giving 750 h.p. under 12 ft. head in two wheels of 1,850 mm. diameter.

Bankruptcy Proceedings.—Woolf Barnett, electrician, 269, Mile End Road, London, E.—Receiving order made on a creditor's petition, September 22nd. First meeting, October 6th; public examination, November 12th; both at Carey Street.

Herbert William Wilson, consulting engineer, 28, Alder Road, West Derby.—Receiving order made September 24th on a creditor's petition.

John Dale Nixon (trading as J. D. Nixon & Co.), electrical and mechanical engineer, 65, Mill Street, Crewe.—The public examination of this debtor was held at the Court House, Edleston Road, Crewe, last week, before Mr. Registrar Speakman. According to the statement of affairs, the liabilities amounted to £1,292, and the deficiency was estimated at £1,115. The debtor attributed his failure to loss on contracts (£180), law costs paid in respect of action brought against him during the past 12 months for the recovery of the amount of trade goods supplied (£200), want of capital, and insufficient profit to meet general expenses. It appeared that the debtor had not been in business on his own account prior to March, 1910. There were 38 creditors, mostly for trade goods, amounting to £616, while there was a claim by a moneylender for £11 10s. In reply to the Official Receiver, the debtor said he had not been able to prepare the account and furnish the particulars asked for, and wanted more time. His books had been imperfectly kept, and he required the assistance of his book-keepers. The Registrar said he could get assistance, but it must be at his own expense. On the application of the Official Receiver, the examination was adjourned.

A Spanish Amalgamation.—As was mentioned some time ago, the ruinous competition between the electricity supply companies in Madrid has been terminated by the establishment of a community of interests between the companies. A similar state of rivalry has existed at Valencia, where four companies have been in keen contest with each other. The Canadian Pearson group, which is particularly active in Spain, has now put an end to this competition by taking over the assets and liabilities of three of the companies, which have thereby been converted into a uniform undertaking. The gas and electricity works of Lebon & Co. only remains outside the combined enterprise.

Strike in Russia.—It is reported that the Russian Allgemeine Elektrizitäts Gesellschaft, in consequence of a strike, has decided to entirely close down its works in Riga. The decision will affect 2,000 workmen.

The Argentine Republic.—The value of the electrical goods imported into the Argentine Republic during the six months ending with June last only amounted to £896,000, as compared with £972,000 in the corresponding half of 1912.

Fire Salvage.—After a large fire recently in an engineering works at Birmingham, the *débris* contained a considerable amount of iron, of such value as to warrant salvage operations. A 42-in. Witton-Kramer magnet, taking 5 kw., was therefore rigged up, and after the larger masses of metal had been removed, the rubbish was shovelled on the face of the magnet, which retained everything magnetic. When the face of the magnet became filled, a box was placed underneath and the current switched off, the magnetic "catch" falling into the box. Expectations were more than realised, and over 2 tons of metal, screws, &c., were salvaged, the bulk of which can be utilised.

New Aluminium Works.—A correspondent says that the British Aluminium Co. have completed negotiations for the acquisition of ground at Burntisland, Fife, and will proceed at once to erect a large manufactory and lay down electric plant, &c.

Catalogues and Lists.—The Phœnix Electric Heating Co., 17, Morwell Street, London, W.C.—Illustrated leaflet relating to their electric log fire radiators and giving prices of same.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—Folder No. 729 illustrates a variety of designs of Aston luminous electric radiators (from two to six lamps), also a number of non-luminous types. Prices and code-words are clearly shown.

The Acme Motor and Traction Co., The Ham, Brentford, London, W.—Twenty-page stock list (No. 25) of dynamos, motors and fans, switches, and all kinds of electrical materials.

Mr. L. Herve, 90, Clerkenwell Road, London, E.C.—Revised catalogue containing 34 stout sheets illustrating a variety of turned and stamped metal parts for telegraph and other electrical and engineering work—terminals, battery fittings, nuts, set screws, studs, &c. Reduced prices are recorded, and a stock of increased variety is carried.

Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—"Book No. 2," of 80 pages, containing numerous illustrations—with brief descriptive matter and notes of prices and code-words—of a variety of telephones and telephonic apparatus for domestic, commercial, mining, and general purposes.

The Arc Lamp-Lowering Gear Co., Railway Appliance Works, Darlington.—New catalogue, containing specification of the firm's arc lamp lowering gear, winches and accessories. Prices and code-words are detailed in tabular form, and eight sheets are filled with illustrations of these specialities and street views showing their use.

Messrs. Siemens Bros. & Co., Ltd., Woolwich.—Leaflet No. C513 gives an illustrated description of the Siemens bell signal indicator for use with mechanically-operated bells for mine shafts and haulage signalling gear.

The London Electric Warehouse Co., Manners Street, York Road, London, S.E.—Two net trade price lists relating to wires and cables; No. 101, 600-megohm grade cables; No. 102, 1,500 and 2,500-megohm grade cables.

Messrs. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.—Sixteen-page catalogue giving full particulars concerning Callender's cab tire sheathing. Sizes, code-words and prices are tabulated for several grades of single conductor, twin, three and four-core cables, also small flexible cord, single, twin, three and four-core.

The British Thomson-Houston Co., Ltd., Mazda House, London, E.C.—A copy of the "Lighting News," No. 2, has reached us. Its 15 small pages are occupied by a number of brief illustrated articles or notes concerning B.T.H. lighting specialities, their uses and economies. Electrical contractors, central station men and others who want numbers of the booklet for distribution should communicate with the company promptly.

Dissolutions and Liquidations.—Davis Electrical Co., Ltd.—Mr. H. Brougham, senior Official Receiver and liquidator, is applying to the B. of T. for his release in this matter. The total payments for fees, &c., have been £18 12s. 2d., and the receipts *nil*, leaving that amount due to the B. of T. The statement says :—"The public examination of H. E. Davis, the managing director of the company, was held on July 23rd, 1912, in connection with the matters referred to in paragraph 11 of the Official Receiver's 'observations,' dated April 12th, 1912. As the result of the examination certain creditors provided funds for the purpose of taking the opinion of counsel, which, it is reported, was to the effect that proceedings might lie against Davis, but that they were not advisable on behalf of the general body of creditors, though individual creditors might recover in certain cases. The assets disclosed in the statement of affairs were not equal in amount to the claims of the debenture-holders, and the Receiver states that there is no prospect of any surplus becoming available for the unsecured creditors."

The Electrical Wiring and Accessories Co., electrical, mechanical and general factors, Aberdare (also latterly trading as South Wales Accessories Co.).—Messrs. R. S. Belsten & T. O. Morgan, have dissolved partnership. Debts, &c., will be attended to by Mr. Morgan.

Brown & Parsons, Ltd., Leamington.—First and final dividend of 4s. 8d. in the £. Mr. C. T. Appleby, liquidator, 26, Corporation Street, Birmingham.

For Sale.—Mr. H. Butcher will on October 9th and 10th offer for sale, by auction in London, gas and electric fittings, illuminating devices, lathes, &c. See our advertisement pages to-day.

Electrical Publicity.—We have received from the City of London Electric Lighting Co., Ltd., several pieces of publicity literature. One is a 16-page pamphlet, on "Electric Light and How to Use It," with illustrations showing good and bad lighting compared; another particularises and shows electrical hot-water apparatus for the office.

Theatre Lighting.—At the London Opera House Osram drawn-wire lamps are installed, also in the whole of the auditorium; in fact, they form the principal illuminant throughout the theatre. Among leading provincial theatres, &c., that have lately adopted these lamps are the Theatre Royal, the Hippodrome and the Palace, at Oldham.

Depression in Austria.—According to a report from Vienna manufacturers of electrical cables in Austria and Hungary are just now passing through a period of depression, orders being extremely scarce.

Trade Announcements.—Mr. C. W. Webster, of Cecil House, Park Avenue, Bradford, sends us a couple of post-card photos showing the carbon works of the Compania Fabril de Carbones Electricos, of Barcelona, the sole sale concession for whose carbons in the United Kingdom and Colonies is held by him. The company have lately secured a repeat contract from the Glasgow Corporation for flame carbons for approximately 1,000,000 ft., and a repeat order for flame carbons from the Melbourne City Council, Australia, and we understand that many other large flame contracts are in hand for other corporations, municipalities, and arc lamp manufacturers. Owing to the continual increase of business, the firm are considerably extending their works. One of the cards shows a corner of the works where extensions are in progress. Besides manufacturing arc lamp carbons, the works make carbon electrodes and dynamo brushes. We have before us a Spanish catalogue of arc lamp carbons, but full particulars of the manufactures can be obtained from Mr. Webster.

To-morrow, Saturday, the Sterling Telephone and Electric Co., Ltd., are transferring their business from Upper Thames Street to more commodious premises at 210, 211 and 212, Tottenham Court Road, London, W., and all communications should be addressed there in future. Telephone number, Regent 4144 (five lines).

Messrs. André Citroen & Co., of 27, Queen Victoria Street, London, E.C., announce that the style of the firm has been changed to the Citroen Gear Co., Ltd.

Mr. H. Featherstone, electrical engineer, of Tunbridge Wells, has removed to new premises at 22, London Road.

The Edison & Swan United Electric Light Co., Ltd., are about to open premises at 10, Deansgate, Manchester, as showrooms.

The Electrical Engineering and Equipment Co., Ltd., of 109-111, New Oxford Street, London, W.C., have secured the sole selling rights in this country and the British Colonies for the machinery and apparatus manufactured by Messrs. Ateliers de Constructions Electriques, of Charleroi, at whose very extensive factories are made:—Large A.C. and D.C. motors and generators, traction motors, electric cranes, centrifugal pumps, haulage and winding gears, &c. The works being situated in the midst of the Belgian coal-fields, the firm have had a unique experience in the electrical equipment of collieries and steel works.

Messrs. J. T. Williams & Sons, engineers and machinery merchants, have removed to 37, Queen Victoria Street, E.C. Their telephone number is "City 3938."

LIGHTING and POWER NOTES.

Aberdeen.—Messrs. Hugh Imlay & Co., Ltd., envelope manufacturers, have recently installed electricity for lighting and power purposes in their works at Park Road, Aberdeen. The contract was carried out by Messrs. Claud Hamilton, Ltd. Energy is obtained from the Corporation supply, and the power is distributed to the different departments by means of various motors. "Osram" drawn-wire lamps are distributed throughout the works and warehouses.

The Lighting and Fires Committee have decided that the entire electric lamps and fittings meantime in the custody of the electricity department be transferred to the lighting department, and that in future all repairs be executed by the lighting department instead of by the electricity department.

Aberdeenshire.—The Committee in charge of the scheme for an installation of electric light in Aboyne has received an offer from Messrs. T. C. Smith & Co., electrical engineers, Aberdeen, acting on behalf of Mr. Duncan, of Tillycorthie, providing for the erection of the necessary generating machinery and laying of the mains. The Committee has to find a site. Current will be supplied at 6d. per unit for light, and at 4d. per unit for power. The cost is estimated at £6,000. The Town Council of Ballater has accepted a similar offer by Mr. Duncan.

Abingdon.—The local Electric Supply Co. has practically completed the buildings required for the plant, and has made a commencement with the laying of the underground cables.

Alderley Edge.—The Committee of the village institute has installed electric lights at various points round the bowling green, and many members are now to be seen playing the game long after darkness has set in.

Australia.—Camberwell (Vic.).—The Council has adopted the revised agreement with the Melbourne Electric Supply Co., Ltd., for lighting the streets of the town with electricity for a period of five years from November 1st next, at an annual cost of about £900. The present agreement with the gas company costs £969 per annum for 212 lamps, while the new agreement provides for 251 lamps, seven of which are arc lamps of 700 C.P.—*Commonwealth Engineer.*

Bacup.—On September 24th, Mr. H. R. Hooper conducted a L.G.B. inquiry into an application of the T.C. for permission to borrow £2,800, made up of £2,100 for H.T. mains, and £700 for sub-station equipment. The expenditure is necessitated by the increasing demand for current, especially in the Stacksteads portion of the borough.

The Balearic Islands.—A small central electric lighting station has lately been completed in the little town of Porreras. One is also being established in the town of Petra.

Barnstaple.—Subject to half the cost of the laying being repaid, the Council has decided to extend the mains to the premises of the South Molton Collar Factory, Mallet's Row.

Bedford.—Last week the Electricity and Street Lighting Committee reported that having considered a letter from the L.G.B., it had abandoned all intention of proceeding further with any installation of the Diesel oil engine plant, and had considered an alternative scheme for the installation of a 1,000-KW. mixed-pressure turbo-alternator with condenser, air filter, and accessories, and recommended that the electrical engineer be authorised to prepare drawings and specifications, and that tenders be invited. This was adopted by the Council.

Blackburn.—In connection with the forthcoming Tradesmen's Shopping Festival, the Electricity Committee has received permission to place electrical devices on the Town Hall and the markets. The Committee has decided to supply electricity for the illumination of the shops at 2d. per unit, and the Tramways Committee proposes to run two decorated and illuminated cars.

Bridlington.—The L.G.B. has sanctioned the borrowing of £1,500, repayable in 20 years, for mains, and £1,500, repayable in 15 years, for services.

Bristol.—The Bristol branch of the Electrical Trades Union having demanded an advance from 8d. to 9d. an hour under threat of a strike on September 27th, the electrical contractors concerned appointed a deputation to deal with the matter.

Burnley.—On Tuesday a L.G.B. inquiry was held into the Corporation's proposal to borrow £36,227 for the purposes of the electricity undertaking, including £7,420 for a 2,000-KW. turbo-alternator, with condensing plant and piping; two 500-KW. rotary converters and transformers, £3,040; new switchgear and alterations, £2,400; two boilers, economisers, cooling-tower, cranes, sub-station, rotaries and transformers, switchgear, transmission cables, mains and services, &c. The town clerk stated that even if the proposed expenditure did not effect any economies at all, the financial position of the works was such that they would stand it. There was an accumulated reserve of £23,000, and the undertaking had paid over to the rates during the last three years £14,500. The demand for electricity was steadily going up. For the year ending March, 1911, there were just over 3,000,000 units sold; in 1912, 3,990,000; and in 1913, 4,524,000. If the largest machine at the works broke down, it was a question whether the remainder of the machinery could supply the demand. The Inspector said he was surprised to see such a small demand for power. In most Lancashire towns it was fairly considerable. The electrical engineer explained that under present conditions they had not been able to entertain inquiries from large users of power.

Castlebar.—Messrs. Bourke & Sons, Castlebar, have given notice to the T.C. that they intend applying to the B.of T. for a provisional order to light the town with electricity.

Carlisle.—On September 23rd Mr. F. O. Stanford held a L.G.B. inquiry into the application of the Corporation for sanction to borrow £7,500 for the extension of the plant at the electricity works and £4,300 for the erection of H.T. feeders for the supply of the outer districts. The Town Clerk stated that the application had to be amended from the sum named to £8,034, the amount of the provisional tenders. The electrical engineer (Mr. F. W. Purse) gave evidence as to the increase of output, and said that the new plant would supply current either for lighting or traction. There was not accommodation for the new plant, and the buildings would have to be extended. The undertaking had been making profit since 1906, and for the past financial year the profit had been £1,510. A working balance had been accumulated of £6,000. It was proposed to install two converters, and the cables would cost £3,000.

China.—Notwithstanding the local, political and other disturbances which have given occasional setbacks to the business of the Compagnie de Tramways et d'Eclairage de Tientsin, the company continues to make steady progress. There are about

8 miles of double-track electric tramways in service in the town, while current is now being supplied to an equivalent of 36,774 10-C.P. lamps, as against only 28,225 at this time a year ago. In view of the increasing demand, especially for power purposes, at some distance from the generating station, the directors have decided to extend the latter, and at the same time to convert the lighting system to alternating current. The new plant, which is expected to be completed by the end of the present year, will comprise two sets of 1,500-KW. steam turbines and generators, working at 5,000 volts, a set of transformers for converting this to 220 volts for lighting purposes, and a 900-KW. converter to supply continuous current to the tramway system. The four existing 325-KW. engines and dynamos will be kept as a reserve plant.

Chobham (Surrey).—The residents are supporting an application by the Woking Electric Lighting Co. for powers to extend their mains to this parish.

Cleckheaton.—Consequent upon an application being made by Messrs. John Walker & Son for the supply of electric power to their Valley Mill, at Moorbottom, in December, and the fact that the feeder cables in this locality are already loaded to their full extent, the Electricity Committee has instructed the engineer to prepare and submit a scheme and estimates for laying larger cables, and allowing for any possible future extensions.

Colne.—The Electricity Committee has accepted a recommendation that a smoke-burning device, known as "Luptarm tubes," be fixed to one of the boilers at the electricity works as a test and for demonstration purposes.

The Electricity Committee is renting temporary premises for the display and demonstration of electrical appliances to consumers of electricity.

In reply to a complaint from the Colne and Trawden Light Railway Co. that the electric current for the tramways was cut off for 47 minutes on the evening of August 2nd, the Council has intimated that this was due to the extraordinary demand for power beyond the quantity agreed upon, for which the department was not prepared.

Continental Notes.—AUSTRIA.—The present electricity supply station connected with the harbour at Trieste having become too small to meet the requirements, and also being unsuitable for extension, it has been decided to establish a new generating station on the River Isongo, at Montalcone, some distance from Trieste. The current will be transmitted at a pressure of 25,000 volts, a transformer station at the harbour reducing this to 2,000 volts.

The municipal authorities of Agram have decided to apply for a concession to utilise the River Litca, near Gospic, for the generation of electricity. The estimated outlay for the installation is placed at 30,000,000 kronen.

The Thomas Parsler Cotton Spinning and Weaving Co., of Krainburg, has applied for a concession to put down plant to utilise certain available water power near that town for the generation of electrical energy for power purposes in its mills. It is stated that about 2,300 H.P. will be available.

A scheme is under consideration to put down a plant to utilise the power of the Kohlbach Falls, near Kossen, in the Tyrol, for the generation of electrical energy for lighting and power purposes.

It is proposed to establish a plant to utilise the water power of the River Berann, near Darowa, Bohemia, for the generation of electrical energy for lighting and power purposes.

BOSNIA.—A new 1,000-H.P. steam turbine and dynamo has recently been installed at the electricity generating station connected with the State collieries at Kreka, Bosnia.

An electricity generating plant has lately been installed in connection with the State Ironworks at Varel, Bosnia; it comprises two boilers fired by the waste gases from the blast furnaces, and a 1,000 H.P. steam turbine and dynamo.

SPAIN.—La Sociedad La Electricista de Sonreca, which has a water-power electricity-generating plant at Romaila la Nueva, has secured a concession to increase the amount of water taken from the River Iago from 6,000 to 11,700 litres per second.

La Sociedad Co-operativa Electrica Popular de Novelda has secured a concession to establish a co-operative central electric lighting station in the little town of Novelda.

A concession has recently been granted to put down a plant to utilise the water power of the River Anna, in the province of Valencia, for the generation of electrical energy for lighting and power purposes.

GERMANY.—The authorities controlling the Upper Rhine power station at Mülhausen contemplate the erection of another generating station, this time on the Schwarzen See (Vosges), in order to utilise the power available at night from the Rheinfelden power station. By means of this station, estimated to yield 180,000 KW. at a cost of 3,500,000 marks, and the power derived from the Rheinfelden station, the waters of the Schwarzen See will be pumped up to the level of the Weissen See (150 metres higher). The first-named lake has a superficies of 150,000 square metres, and the second 260,000 square metres. The return flow of the water to the works, through a specially-constructed channel, day and night is expected to yield a corresponding quantity of electric energy.—*Zeit. f. das gesamte Turbinenwesen.*

An electricity-generating station, operated by water-power, has lately been completed at the Listertalsperre, by the Ruhrtalsperren Verein, of Essen. The plant at present comprises two 500-H.P. high-pressure turbines, built by Messrs. Amme, Giesecke and Co., of Brunswick, and two 420-KW. alternators, supplied by the Bergmann Elektricitätswerke Gesellschaft, of Berlin. Two additional sets of turbines and dynamos, each of 335 KW. capacity, are shortly to be added.

The shipbuilding firm of Schichau, of Elbing, are about to build a great reservoir and water-power installation between Braunsberg, in East Prussia, and Elbing. The reservoir will collect in good years some 100,000,000 cubic metres of water. The power capacity of the installation will amount to between 4,000 and 5,000 H.P. Most of the electricity generated will be utilised in the great Schichau establishment at Elbing, the surplus being disposed of among the neighbouring towns and agricultural districts.

A novel electric lighting plant has recently been installed at the railway station at Ostrowo, Silena, for the supply of electricity for lighting and power purposes at the station at Skalmierzce, on the German-Russian frontier, 10 miles away. The plant consists of two 180-H.P. gas engines, each coupled up to a continuous-current and an alternating-current generator. The novelty lies in the fact that the suction gas used to drive the gas engines is manufactured from the carbon scraped from the smoke boxes of the railway locomotives. There are several installations of the kind in the Konigsberg railway district, but new ones are now not so numerous owing to the fact that on account of the better utilisation of the coal in the modern superheated steam locomotives, the smoke-box residues are not sufficiently rich for gas-making purposes. As a result, plants to utilise the smoke-box carbon are only being put down where fuel is dear and labour cheap.

An interesting hydroelectric undertaking is about to be carried out near Orbey, in Alsace-Lorraine. Two picturesque lakes here, much frequented by tourists, the Lac Blanc and the Lac Noir, separated by a rocky barrier, have a difference of surface of about 100 metres. It is intended to join these two lakes by a tunnel, and by means of pumps to raise about 1,000 cubic metres of water from Lac Noir to Lac Blanc during the night. This will be allowed to flow back to Lac Noir, with the natural outflow of the lake, during the day, and the flow will be utilised for generating electricity, which will be employed for lighting and industrial purposes and for traction on the Alsace railway system.—*Journal Pratique de l'Electricité.*

FRANCE.—The scheme of distribution in Paris, detailed in 1909 in *l'Industrie Electrique*, is now, according to our contemporary, rapidly approaching completion. The two central stations—Nord and Sud—of the Compagnie Parisienne de Distribution, which will render Paris independent of all external sources of energy, are practically completed, and one (the Nord) will very shortly be put in commission. Concurrently with these extensions and the extensions to the sub-stations, the motor load has considerably increased, principally as a result of the reduction of the price per KW.-hour to 2·9d. per unit for small loads, with special tariffs reducing this figure to 1·4d. per unit in the case of larger installations. The direct result is an increase of the day load and an improvement in the diversity factor. The distribution area is divided into four zones, each zone being supplied with electrical energy in a different form; thus there are networks of single and two-phase (five-wire) alternating current and three and five-wire direct-current supply. The single-phase network is fed from static transformer stations, which also supply high-tension energy to certain users. The two-phase network is fed from distributing centres, where high-tension switches of the cell type connect the incoming mains to banks of transformers placed at convenient points of the network. These centres form an entirely new feature of the Paris system, and have already been considerably extended as regards the number of H.T. cells and corresponding transformers. No serious interruption of their service has yet been recorded. Rotary transformers supply two direct-current networks, one three-wire and one five-wire system. These two zones slightly overlap, in order to balance the load to better advantage, and herein lies the only deviation from the original scheme of dividing the Paris area into four zones characterised by the forms of supply. The cost of changing over the mains from two to three, three to five or five to three-wire has been borne by the local authorities, and the work has been carried out by them.

The *Revue Electrique* learns that the Compagnie l'Electrique Centre-Ouest has applied to the State for a concession in respect of 195 communes representing nearly 300,000 inhabitants. The communes are divided among the following departments:—Deux-Sèvres (31), Vienne (60), Vendée (14), Charente (14), Charente Inférieure (21), Creuse (18), Indre (17), and Haute Vienne (20).

The municipal authorities of Rocroi (Ardennes) have granted a concession to the Société des Ardennes Electriques for the electric lighting of the town.

La Société Normandie de Distribution d'Electricité is the name of a new company which has just been formed in Paris (38, Rue Saint Georges) with a capital of £160,000 to establish electricity supply stations in Normandy.

Croydon.—The visit of a party of Thornton Heath ratepayers to the electricity works on Saturday was made the occasion for the formal inauguration, by Alderman D. B. Miller (chairman of the Lighting and Electricity Committee), of the new turbine-driven generating plant just installed. This will supply practically the whole of the alternating-current lighting, and also a portion of the direct-current lighting (for the centre of the town). The turbines can be worked either with high-pressure steam or with exhaust steam, and a great saving in the coal bill is thereby anticipated. The makers of the turbine were Messrs. Belliss & Morcom, and of the generating plant Messrs. Siemens Bros. The capacity is about 3,000 H.P., and the cost, roughly, £7,000. The thanks of the company were extended to the borough electrical engineer (Mr. A. C. Cramb), the deputy manager (Mr. J. W. Burr), the station superintendent (Mr. D. Cowan), and the sales manager (Mr. A. C. Bostal).

Coxhoe (Co. Durham).—The P.C. has under consideration a proposal to have the streets lighted by electricity. The County of Durham E.P.D. Co. is to furnish an estimate of the cost, after which a further meeting will be held.

Dartford.—With reference to the U.D.C.'s proposal to give a supply of current to Crayford, Lord Tredegar's agents have objected to the cables being placed overhead on his estate. Should the agents, upon reconsideration, still refuse consent, the cables are to be laid underground.

Derby.—The Council is recommended to rent for two years premises in Victoria Buildings, London Road, for use as a showroom in connection with the electric light undertaking.

The E.L. Committee recommends the adoption of an alternative system of charge to occupiers of dwelling houses, of 10 per cent. on the rateable value of the premises, plus ¾d. per unit for all current consumed in excess of the number of units equivalent in value at the ordinary lighting rate to the amount of the percentage charge.

Dromore (County Down).—In our last issue the word "company" should not have appeared. The scheme is yet under consideration by the Urban Council, and it will be finally decided at a special meeting.

Eccles.—A 50-KW. transformer is to be installed under the footway in Liverpool Road, and a low-tension distributing main is to be laid from there for a distance of 250 yards.

The Public Lighting and Electricity Committee has approved a recommendation of the electrical engineer for a rearrangement of street lamps at Peel Green, providing for four new lamps and the refixing of 12 existing lamps.

The extension of the mains from the junction of New Lane with Worsley Road to the site of the proposed new church off Parrin Lane, has been confirmed by the Electricity Committee.

Fleetwood.—The Council having been asked by the Lancashire and Yorkshire Railway Co. for terms for the supply of current for lighting and power at Fleetwood Station and Wyre Dock, are making inquiries as to charges elsewhere to railway companies.

Flintshire.—A scheme is projected for introducing electric lighting in the districts of Connah's Quay, Shotton and Queen's Ferry. It is thought that there would be a considerable saving of expenditure if the generating station were erected at the sewerage works in the Deeside district.

Haslingden. — On September 25th, the electrical manager submitted to the T.C. an estimate of the probable cost of laying a cable along Helmshore Road to certain mills at Helmshore, together with a tender received from Messrs. Siemens Bros. & Co., Ltd., for the execution of this work. The manager was instructed to invite tenders from other cable-makers for this cable, and the placing of the contract was left in the hands of the chairman and vice-chairman.

Heston-Isleworth. — Mr. P. E. Rycroft, electrical engineer, has been authorised by the U.D.C., upon receipt of an application for a supply of current to the Brentford Union offices, to extend the electricity mains along the Twickenham Road, a distance of 580 yards, at a cost of £300; and also to lay a cable into the Hounslow barracks, at a cost of £150, for the purpose of furnishing a supply of current to the new gymnasium.

It is proposed to substitute 35 100-C.P. lamps, at £4 each, in place of the arc lamps which now light Richmond and St. Margaret's Roads. A saving of £100 per annum is anticipated.

Ilford.—At the last meeting of the U.D.C., the Electricity Committee recommended, on the report by the electrical engineer, and as an alternative to the present rates, that from the December readings (1) a primary charge of 12½ per cent., of the rateable value of all private houses be made payable in four equal quarterly instalments, together with a fixed rate of ½d. per unit on all current consumed, less the usual discount of 5 per cent., for prompt payment; and (2) that for shops, warehouses, or business premises electrically lighted throughout, and using or paying for electricity up to 2,500 units per annum, a charge of 3½d. per unit be made; for 2,501-5,000 units per annum, 3d. per unit; for 5,001-10,000 units per annum, 2¾d. per unit; and for 10,000 and upwards, 2½d. per unit. Payments must be made at the rate of 3½d. per unit for the quarters ending June, September, and December in each year, and any allowance due to the consumer is to be credited upon the account for the quarter ending March in each year. As regards public houses, &c., a charge of 2¾d. per unit is to be made as an alternative to the present maximum demand rate.

The U.D.C., on September 23rd, approved plans and estimates for a refuse destructor, to cost £21,578.

Ingleton.—The P.C. has accepted a tender of £42, from the Electric Lighting Co., for street lighting from August 1st to April 30th.

Kendal.—Messrs. Austin & Paley, of Lancaster, have been instructed to prepare a scheme for installing electric light in St. Thomas's Church, together with an estimate of the cost.

Leeds.—Mr. Hooper held a L.G.B. inquiry last week into an application by the Corporation for powers to borrow £168,000 for developing the electricity undertaking. The Town Clerk (Sir R. E. Fox) explained that the sum desired included £100,000 for mains, £38,000 for machinery, and £30,000 for substations, transformers, &c., and it was necessary that work should be proceeded with as soon as possible, because during the winter of this year the department would have to deal with a load of 13,000 KW., and during the following winter it was expected that this would be increased to 20,000 KW. It was suggested that the present plant owned by the Corporation should be maintained as a stand-by. The city electrical engineer (Mr. C. N. Hefford) gave evidence in reference to the application. The Inspector said that evidently at no far distant date a good deal of the original plant put down would be of no commercial or other use, and, that being so, both with regard to buildings and plant, there would probably be a very considerable sum of money which would still be outstanding in the next two or three years when it would be necessary to make provision for the new plant. There was only a paltry £3,000 in the present reserve fund, and during recent years there had apparently been no intention of adding to it. Whereas in 1907 the fund stood at about £14,000, it was now only £3,500, and at the same time the profits had increased from £3,400 in 1907 to £15,500 in 1913. He was looking at the matter from a commercial stand-point. The Corporation was putting in very large boilers which would in effect supersede the old Lancs. boilers now in use; and yet there was a considerable debt outstanding when a fund ought to have been built up with the money and profits earned. The time when new plant would be needed was getting nearer every month, and he would like to know what the Corporation proposed to do about the matter. Even if the Board allowed the matter which he had mentioned to go by on this occasion, it was one which must be anticipated. It was a question of obsolescence rather than of depreciation; but it was one which ought to be met. What would the City Council do in two or three years' time, when they had derived the income and had put nothing by to the reserve fund? He had mentioned the matter because it was a serious question, and one which could not be missed on the next occasion. It was drawing the long bow to say that it was not necessary to-day, and there were no funds to meet it. If the profits had been earned and dealt with in other ways, what would be the position when they were applying for a large sum for another station, and there were no funds in hand to wipe out the outstanding debt on the old station? It might mean a great increase in the rates in one year, and it could not be put off much longer. The town clerk replied that the reserve fund of £14,000 had been abolished when a necessary financial arrangement between the Consolidated and City rates was made, the Corporation deciding to take these reserve funds. The plant which the Corporation now had had not been superseded, though the matter which the Inspector had raised was quite appreciated by the authorities, and would be taken notice of. The electricity undertaking was a prosperous one, and the revenue dealt with was likely to increase very greatly.—There was no opposition to the application, and the inquiry was closed.

London.—STEPNEY.—Mains are to be extended through several roads in the borough. Subject to the approval of the B. of T., an agreement is to be entered into with the Shoreditch B.C., similar to that now existing between the Council and Poplar, for "stand-by" or "reciprocal" supplies.

The Port of London Authority is to be supplied, under agreement, with electricity for pumping purposes for a period of 10 years, by the B.C. The minimum annual consumption for the purpose is to be 400,000 units at a load factor of 33⅓ per cent.

Consequent upon a recent accident at the Limehouse station, the department cannot take the full coal supply contracted for for some time. It is therefore proposed that the Poplar Borough Council shall take 300 to 400 tons, paying 14s. per ton, to help the Council out of the temporary difficulty under its coal contract.

POPLAR.—The Electricity Committee, in considering a comparative statement of the annual estimate and the actual results of the undertaking during the past year, states that, but for the inclusion of £625, being 15 months' contribution to superannuation and pension fund, which was not included in the estimate, the net result (a surplus of £3,603) has been fully realised (actual result £3,133), despite the exceptional prices ruling for coal since the strike in March, 1912, the excess cost in this respect amounting to £2,189. The comparison, the Committee continues, is also affected by a different allocation of salaries, inasmuch as all salaries have hitherto been allocated to management charges, but, owing to the transfer of the charge engineers to the staff, it has become necessary to divide salaries into three distinct headings—viz., generating, distribution, and management. Eliminating coal from the comparative figures, the remaining costs were fairly accurately estimated—viz., total costs (estimate), £29,545; actual, £33,964; coal (estimate), £14,103; actual, £18,851; total (estimate), £15,442; actual, £15,113.

Manchester.—The question of the erection of new electricity works has recently been considered by the Electricity Committee, and a scheme has been drawn up which will make it possible to supplement the output at the Dickinson Street and Stuart Street stations. It is proposed to acquire 11 acres of land at Trafford Park. The scheme provides for the ultimate erection of a new station with an output of 100,000 KW.—25 per cent. more than the present total capacity—but it is proposed to carry out the work by stages, and the first instalment of plant will probably have an output of 25,000 KW. Estimates indicate that if such provision is made within the next three years, it will suffice to 1919, and at

this rate of increase the works would not reach the maximum dimensions for something like 15 years. The site proposed is well out of the city. The advantages contemplated include (1) saving on coal carriage (estimated at possibly £17,000 per annum); (2) the likelihood of water being available for condensing purposes from the Ship Canal; in which case the erection of water towers will not be necessary. The final effect of all the possible economies will be that whereas the cost of the plant at the existing stations works out at £20 per KW., that at Trafford Park will be, according to the calculations, scarcely more than half that amount. The chairman of the Electricity Committee (Councillor Dagnall) stated last Friday that the matter was urgent. For some years past the maximum load had been increasing at the rate of 3,000 or 4,000 KW. a year. It was essential that the department should be able to cope with the greatest demand made upon it.

Mansfield.—The T.C. has applied to the L.G.B. for a loan of £3,000 for mains and services.

Paraguay.—Senor Jesús Basante proposes to install in Villa Rica an electric power station to generate light and power for tramway and telephone services.—*Review of the River Plate.*

Portrush.—The U.D.C. has decided to acquire a site for the proposed power station.

The Philippine Islands.—The Suburban Railway Co. has secured a concession to put down a plant to utilise the water power of the River Caliraya, in the Province of Laguna in the generation of electrical energy for lighting and power purposes in Manila. Two other concessions to utilise water power in the Philippine Islands have also lately been granted.

Salford.—The T.C. has appointed Messrs. C. S. Allott and Sons, of Manchester, to prepare the plans, &c., for the sub-station required for the additional supply required by the Manchester Ship Canal Co.

South Africa.—The Siemens-Schuckert Co. has recently completed an installation of 12 alternating synchronised motors at the Rand mines. The machines, which run at a speed of 3,000 R.P.M., are similar in design to alternating generators intended to be driven by steam turbines; they work at 1,700 volts, 50 periods per second, and develop 2,550 H.P. Each motor is provided with a special starting arrangement comprising a starting motor and coupled synchronised 525-KW. generator.

Stalybridge.—The Joint Tramways and Electricity Board has received L.G.B. sanction to the borrowing of £9,250.

At the meeting of the Joint Board on September 25th, discussion took place upon a minute that the question of coal should be left to the chairman of the generating station committee and the engineer. It was suggested that members were shirking their duty in this matter, and were throwing the responsibility on to two individuals. Alderman Ridyard said they were finding their action to be wise. Alderman Noel said they used 2,500 tons of coal per month, and during the last three or four months they had been buying coal under the arrangement which was being criticised, and he dared guarantee they had saved £600 to the Board.

Stoke-on-Trent.—The T.C. has accepted the offer of Messrs. Siemens Bros. Dynamo Works Co., Ltd., to provide boosters to enable the motor-generators to be used for the load for the forthcoming winter, and that as soon after as possible they rewind the stators, provide new pole-pieces, and complete the plant to the reasonable satisfaction of the engineer. Regarding this matter, the engineer reports that the tests of the Siemens motor-generators in the power house had shown that they did not comply with the guaranteed performance.

Sutherlandshire.—The village of Brora has given up its paraffin lamps and gone in for electric light. The power comes from Messrs. Hunter & Co.'s woollen factory. The lamps number 40, of 25 and 50-C.P. each.

Todmorden.—A new scale of charges for electricity has been adopted by the T.C. It is proposed to supply current for lighting, heating and cooking, small motors for purely household work, &c., at a fixed rate per annum of 10 per cent. of the rateable value of the house, and a net charge of 1d. per unit used. The sliding scale for power is based upon the consumption per quarter irrespective of H.P. as follows:—1 to 250 units per quarter, 2d. per unit; 250 to 500, 1¾d.; 500 to 1,000, 1½d.; 1,000 to 2,500, 1¼d.; 2,500 to 5,000, 1⅛d.; 5,000 to 10,000, 1d.; 10,000 to 20,000, ⅞d.; above 20,000, ¾d.

Talgarth.—The P.C. has accepted the offer of the Talgarth Supply Co. for current for lighting the Town Hall, free for the first year, and 3d. per unit afterwards. An offer from the Enig Electric Co. was at 3½d. per unit, including the cost of necessary alterations.

Tunbridge Wells.—The charge for current for heating, cooking and power is to be lowered by the Corporation from 1¾d. to 1d. per unit. The question of installing additional machinery has been deferred.

Walthamstow.—Sanction has been received from the L.G.B. to the borrowing of £828 for a new feeder, and £1,926 for a natural draught cooling tower. Tenders are required for the construction of a tank for the Council's new water cooling tower, with and without expanded metal. A sub-committee has been appointed to consider and report as to the price charged to the tramways department for current.

West Hartlepool.—The accounts for the year ended March 31st last, show that the capital invested in the electricity undertaking was £119,317. There was a gross revenue from electricity of £17,255, and a balance, after paying working expenses, of £6,270.

Whitwood (near Pontefract).—The U.D.C. proposes to extend the electric lighting system.

Wimbledon.—In consequence of the mileage and resistance of the Post Office cables and wires used in connection with the Gamewell fire alarm system now being installed in the borough, the Council find that it will be necessary to purchase 66 accumulators additional to the 60 provided for in the contractor's (G. L. Beasley) tender. Mains are to be extended to the junction of Bathgate and Queensmere Roads at a cost of £250. The Sub-Committee appointed by the Council to consider as to the desirability or otherwise of providing additional generating plant at the electricity works, have issued their report. They state that they have considered a report of the electrical engineer upon (*a*) the necessity for the provision of additional generating plant, and (*b*) the provision of a condensing water-cooling tower, and that they are of opinion that it is necessary, in order to secure an adequate margin of stand-by plant, and thus provide for a continuity of supply in the event of any of the existing plant breaking down, that a 1,500-KW. turbo-alternator be installed at the electric lighting station. Accordingly, they invited tenders for the alternator, with condensing plant, and all necessary foundations, pipework and auxiliaries, and for an overhead crane. Twenty-five tenders were received, and that of the British Thomson-Houston Co., Ltd., for the turbo-alternator, and that of H. Morris, Ltd., for the crane, were accepted. The total estimated cost of the scheme is put at £9,900. With regard to the proposed provision of the water-cooling tower, the engineer recommended that the major portion be postponed for the present, but that the portion relating to the construction of a cascade and improved carrier for the condenser cooling water from the works to a tank near the river Wandle be proceeded with at a cost of £250. This work is to be carried out.

Winton.—The new Church of St. Mary Magdalene, now being built, is to be electrically lighted.

Wolverhampton.—The L.G.B. has fixed October 8th for an inquiry into an application by the T.C. for a loan of £22,000 for electricity purposes.

TRAMWAY and RAILWAY NOTES.

Barnoldswick.—The Light Railway Commissioners have decided that the application for Barnoldswick and Gisburn Light Railway Order should be granted, subject to the withdrawal of the proposals for a short junction line and to the production of evidence as to the intended means of raising capital.

Brazil.—In their annual report, the directors of the South Brazilian Railways Co., Ltd., state that on account of the works for the electrification of the tramways not being completed on October 1st, 1912, for the reason given in the last report, it was found necessary to grant the contractor a further extension of six months for the completion of the works—namely, until March 31st, 1913. In the latter part of December the Banque Fontaine et Cie., which was intimately connected with the contractor, went into voluntary liquidation, and the contractor, on account of his liabilities, was unfortunately unable to carry out his engagements, and was compelled to come to an arrangement with his creditors. In consequence, the company, as on January 1st, 1913, took back the working of the tramways and electric lighting system, and regained possession of the whole of the property. The board made arrangements for an advance of sufficient funds to meet the requirements of the company, against certain of its unissued debentures. All the works, with a few minor exceptions, have been completed, and the tramways have been operated by electricity since January last as regards passenger traffic, but pending the installation of additional plant now on order, the goods traffic is being dealt with by animal traction. The question of the erection of the hydro-electric works is still under consideration.

Burnley.—The Tramways Committee is to be asked to consider the question of granting cheaper fares for scholarship children. Mr. T. C. Ekin has held a L.G.B. inquiry into an application by the Corporation to borrow £36,227 for the electricity undertaking.

Birmingham.—At the meeting of the Corporation on Wednesday (October 1st) the General Purposes Committee submitted a draft of the Council's Parliamentary Bill for the 1914 Session. A large number of the clauses in this Bill are the same as those which appeared in last Session's abortive Bill. Part II of the Bill deals with tramways and omnibuses, and in this connection it may be remembered that the Tramways Committee recommended the Council to construct a line from Hagley Road, *via* Broad Street to Paradise Street, and a connecting line across Victoria Square, and along Colmore Row to join the existing tramways, and that the

latter proposal was referred back to the Committee with instructions to prepare a scheme that would avoid crossing Victoria Square whilst connecting with the existing tramway in Colmore Row. The Committee has now come to the conclusion that there is no satisfactory alternative to the route proposed by it, and it has therefore decided to abandon the projected line down Paradise Street to the corner of Ratcliff Place, and terminate the Broad Street tramway in Easy Row by a junction with the proposed tramway from Suffolk Street along Easy Row and Great Charles Street. The construction of a new single line of tramway from Easy Row along Edmund Street to connect with the existing tramway in Edmund Street, thus making a complete circuit, is also proposed.

Bradford.—The experiment which has been tried by the Bradford Corporation tramway department, of requesting passengers to obtain their tickets as they board the car instead of calling upon the conductor to make a journey upstairs to distribute the tickets, has proved of considerable inconvenience to the public. It is thought that the suggestion is carried too far when, at a city terminus, a large number of people are pushing and hustling to get on to the car through the conductor compelling all top-deck passengers to obtain tickets before they ascend. A suggestion is made that tickets should be issued at the barriers or at little kiosks in the streets at the termini, and so allow the conductors to devote the whole of their time to looking after passengers *en route*. This is done on the Continent, and it is thought would get over the difficulties which are at present being experienced in the distribution of tickets alike by the passengers and the conductors.

Cardiff.—The Council has referred to Committees a demand by its employés for 2s. 6d. a week advance for all other than skilled mechanics, a minimum of 6½d. per hour for motormen and conductors, and advances of 2s. 6d. to other employés in the tramway and electricity department.

China.—Pekin.—It is proposed to construct electric tramways in Pekin, the undertaking to be financed and managed solely by Chinese. At the beginning of September Chinese engineers were engaged in settling the details of the proposed routes.

Connah's Quay.—The Council recently received a letter from the manager of the Wrexham District Electric Tramways Co. stating that his company were preparing to enter upon a scheme for a motor-'bus service for passengers between Chester and Flint, 12 miles distant on the north-west coast. The new service is to include Saltney, Sandycroft, Queensferry, Shotton, Connah's Quay, and thence to Flint. There was no opposition to the proposal.

Continental Notes.—Austria.—Another hydro-electric installation is projected by the Austrian State Railways, this time to provide electric current to work the Vintschgau Railway. The site of the proposed station is the falls district on the Etsch River between Laas and Göflau, where a dam and a reservoir are to be constructed and a 6½-kilometre canal to conduct the impounded water to the projected power house near Schlanders. According to estimates an average power of 8,000 H.P. would be yielded, rising to a maximum of 11,000 H.P.

In connection with the electrification of the railways in the Innsbruck district, the Austrian State Railway authorities are reported to be contemplating the erection of three large electricity-generating stations in the Putter Valley.

Germany.—A scheme is at present under consideration for the construction of an electric railway along the banks of the Rhine between Wiesbaden and Schierstein.

A syndicate is in course of formation with the object of carrying through a scheme for the construction of an electric railway between Pirmasens, Dahn and the Vorderpfalz.

Spain.—The Electric Tramway Co., of Vigo, has been authorised to construct new tramway lines and to extend the service in that town.

Italy.—Negotiations are in hand with regard to the electrification of the tramway between Rome and Civita Castellana.

The *Bulletin Commercial*, of Brussels, states that the provincial council of Alessandria is about to grant concessions for 663 kilometres of new electric lines in that province in three groups.

East Ham.—The London General Omnibus Co. have requested the Council to remove its tramway standards in a portion of Forest Drive in view of the possible danger to the public travelling on their 'buses. At the last meeting of the Town Council the tramways engineer pointed out that considerable expense would have to be incurred in the near future in the Manor Way, where subsidences in the track and roadway have occurred since the inauguration of the service of 'buses. There is a deficiency of £1,217 on the tramways undertaking during the year ended March 31st last, being an increase of £729 as compared with the previous 12 months. The total income amounted to £57,969, including £919 from advertising and other sources, against an expenditure of £45,808, of which £18,078 was for traffic expenses, £11,657 for maintenance and renewals, and £9,522 for power. This shows a gross profit, including bankers' interest, of £12,256, from which has to be deducted £13,473 in respect of the deficiency from the previous year (£488), interest on loans (£5,806), redemption of debt (£6,725), and £454 for the extinguished debt in respect of loans for joint machinery in connection with the electricity undertaking, leaving the deficiency above mentioned.

Flintshire.—The scheme for the proposed new light railway for Flintshire was discussed at a meeting of the County Council last week. There was a recommendation from the Parliamentary Committee that the scheme be approved, and that the County Council contribute the sum of £20,000, in shares or by loan, on terms to be agreed upon, such contribution to be dependent upon the raising of the whole of the necessary capital. It was resolved that a special meeting of the Council in Committee be called to go fully into the whole of the details of the scheme.

Glasgow.—A Special Committee of the Glasgow T.C. is to consider and report as to the feasibility of establishing a system of tube electric railways from east to west (say, Shettleston to Clydebank), and from north to south (say, Bishopbriggs to Rouken Glen).

Halifax.—The Tramways and Electricity Committee has decided that on and after the end of the September quarter, the charges for the supply of electricity for lighting purposes within the borough be as follows:—

Accounts up to 1,200 units per quarter, 4d. per unit; current in excess of 1,200 units per quarter, 2d., "excepting that, in the case of shop premises, where electricity is the chief illuminant for lighting the interior of such premises, then all electricity used for exterior lighting or in connection with illuminated advertising signs at such premises may be obtained at the rate of 2d. per unit; and that a discount of 5 per cent. be allowed on all accounts if paid within the prescribed time."

Lanarkshire.—On September 25th the new part of the Lanarkshire Tramways Co.'s system between New Stevenston Cross and Bellshill Cross was opened for traffic.

Preston.—The Tramways Committee has issued a report containing a scheme which, if approved, will be included in a general application for extended powers next session. The plans comprise a line from Garstang Road, along Addison Road to the Cattle Market, then across the two lines of railways and the canal to join the present terminus in Long Lane, Ashton. Another line would branch from Withy Trees along Lytham Road, down Brook Street, and on to Corporation Street and Fishergate. Another line would proceed along London Road to the bridge over the Ribble at Walton-le-Dale.

South Lancashire.—A scheme is under consideration for utilising the tramways for conveying goods from the Liverpool Docks to the various towns served by the South Lancashire Tramways Co. It is proposed to create depôts at different points along the routes, and from these to distribute goods by motor lorry to places to which tramcars do not run. It is intended to construct special cars for this traffic.

Stirling.—The offer of Messrs. Balfour, Beattie, Paul and Co. to provide Stirling with electric tramways is under consideration. Mr. Robertson, Greenock, and Mr. Fisher, Dundee, are to report to the Council on the subject.

Walsall.—A scheme is being matured by the Tramways Committee for the purpose of extending the tramway system to many of the outlying districts. Application is to be made for extension powers, and when these are obtained it is proposed to continue the system to Cannock, Pelsall, Brownhills, and Great Barr. The extensions to Cannock will tap *en route* the villages of Landywood and Wyrley. It is proposed to run to Pelsall and on to Brownhills, and then join up with the system at Walsall Wood. Motor-'buses on the railless trolley system will, it is believed, be immediately brought into requisition when the necessary powers have been obtained, until the whole district can be thoroughly linked up with Walsall.

York.—The Joint Committee of the Tramways and Streets and Buildings Committees of the York Corporation has decided to recommend the Council to extend the tram-lines down the new street from Pavement to Piccadilly and Hull Road, *viâ* Walmgate; to establish railless cars on the following routes:—Nessgate to Laverthorpe and Heworth; Nessgate to Huntington Road, *viâ* Goodramgate and Monkgate; and from the station down Bootham to Clifton; and also to extend the service over the bridge to be constructed over the Ouse at Clifton Scope to Leeman Road.

TELEGRAPH and TELEPHONE NOTES.

Africa.—Several large mines operated in Central Africa have recently abandoned their telegraph lines from the railroads to the mines and established connections by wireless. The reason given for this action is that it was difficult to maintain the wire lines on account of the demand for the wire by native women for ornamental purposes.—*Telegraph and Telephone Age.*

Telephony in Mining.—Last Friday 150 members of the Institution of Mining Engineers witnessed successful experiments with the wire-less telephones which have been installed in the Pilkington Colliery Co.'s new collieries at Astley Green, in South Lancashire.

Canada.—Arrangements have been concluded for the reduction of the cable rates between Canada and the British West Indies by half. To enable this to be done, the British Government is to make an annual contribution of £8,000, and Canada is to contribute a similar amount.—*Times.*

Italy.—Acting on the suggestion of Mr. Marconi, Signor G. Afani, head of the Florence Observatory, has set up a wireless receiving installation in the Cathedral at Florence, hanging its antennæ within the building so that all parts of the equipment are contained within an enclosed space. Experiments made at night showed that messages from Paris, Toulon and Madrid were faithfully recorded, the efficiency of the receivers being only slightly less than if they were in the open air.

Australia.—A recent award of Mr. Justice Higgins in the case of the Postal Electricians' Union has the effect, according to the Federal Public Service Commissioner, Mr. D. C. McLachlan, of "eating up 99 per cent. of the revenue" of the telephone department, which is chiefly concerned in the award. The award entails an increased cost of at least £30,000 per annum in respect of salaries alone. The hours of work are reduced from 46½ to 44 per week, and the aggregate loss of working time represents an annual value of £10,000.

Submarine Cables and Trawlers.—A report to the Board of Agriculture and Fisheries, recently issued, details the proceedings of the Board with regard to the complaints of damage to submarine cables by trawlers, and the steps taken to diminish the trouble by warning the owners, improving the otter-boards, &c. Up to the end of 1912, 1,211 British steam trawlers had been inspected. It is stated that a very marked decrease took place in the number of cases of interruption to cables reported after 1909, when the Board first took action in the matter; off the Land's End, and the south and west of Ireland, where most of the cases occurred, the following interruptions due to trawlers were recorded: 1908, 16; 1909, 18; 1910, 3; 1911, 8; 1912, 6.

A conference with the States of Western Europe was held on June 13th last, with a view to international co-operation in the matter.

France.—The modified telephone rates between England and France will not come into operation for some weeks. Three-minute calls between Paris and London, Rouen and Birmingham, will cost 4s.; between Lyons and London, 6s.; between London and Bordeaux, and Liverpool and Nantes, 8s. It is anticipated that there will be a considerable reduction for night calls.

Russia.—The wireless stations at Marasale, on the Kara Sea, the Island of Vaigatch, and the Yugor Strait, are all now in communication with that at Archangel.

Postal Servants.—The Association of National Telephone Engineers on Friday last passed a resolution severely condemning the recommendations of the Holt Committee, on the grounds that many of the officers transferred from the service of the National Telephone Co. had suffered in position and prospects, and that the rates of pay proposed were inadequate.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Perth.—November 12th. For the P.M.G. Lamp signalling trunk line switchboard, of five sections, &c.

New South Wales.—March 18th, 1914. Tenders are invited by the Postmaster-General for the supply, delivery, and erection of automatic telephone switchboards, with associated equipment, at the Epping, Ryde, Hunter's Hill, Drummoyne, Wahroonga, Paddington and Waverley exchanges, New South Wales.—*Australian Mining Standard.*

Victoria.—November 12th. For the Victorian Railways; flame arc lamps.

November 4th.—For the P.M.G. Eight automatic telephone switchboards.

November 12th.—Victoria Railway Department. State coal mines, Wonthaggi. The time for tenders for haulage engine and electrical equipment has been extended to November 12th, and a copy of the specification may be seen in London (C.I. Department, Board of Trade).

November 15th.—Melbourne Suburban Railways. Overhead electrical equipment of permanent way and overhead transmission mains. See "Official Notices" September 12th.

October 15th.—20,000-volt H.T. switchgear, L.T. switchgear and accessories for the power stations and sub-stations. See "Official Notices" September 19th.

Victorian Railways.—November 12th. 17 miles lead-covered impregnated paper-insulated copper cable for track-locking roads. November 19th.—10 tons sulphate of copper for electrical purposes. Specifications may be seen at Board of Trade C.I. Dept. in London.

October 7th.—Six 60-K.V.A. and one 30-K.V.A. single-phase transformers, for the Melbourne City Council. See "Official Notices" September 19th.

October 7th.—33,300 carbon-filament lamps, for the Melbourne City Council. See "Official Notices" September 19th.

October 8th.—Melbourne City Council. Lead-covered cable. See "Official Notices" September 26th.

December 14th.—Two sections switchboard, common battery multiple. See "Official Notices" to-day.

South Australia.—Adelaide.—November 12th. Postmaster-General's Department. Lamp signalling trunk line switchboard. See "Official Notices" September 26th.

Brisbane.—November 19th. For the P.M.G. Wire, bronze, 100 lb. per mile. See "Official Notices" September 26th.

Austria.—October 17th. The authorities of the North Austrian State Railways in Vienna, are inviting tenders for an installation of electric lighting at the goods railway station at Cracow.

Belgium.—October 15th. The municipal authorities of Liége (Annexe de l'Hotel de Ville) are inviting tenders for a 151-KW. steam engine and dynamo and one set of 26·4-KW. capacity. Particulars can be obtained from the Service de l'Electricité, 42, Rue Lambert-le-Begue, Liége.

Canada.—October 25th. Regina, Sask., City Commissioners. One 3,000-KW. steam turbine with condenser; one 25-ton hand power crane. Specification from Mr. E. W. Bull, Superintendent of Light and Power Department, Regina. Deposit: 5 per cent. of tender.

Cardiff.—October 17th. Corporation. Passenger tickets and ticket punches for trams. See "Official Notices" to-day.

China.—Shanghai.—October 17th. Extra-H.T. pilot cable, &c., for the Council. See "Official Notices" to-day.

Eastbourne.—October 3rd. Wiring, &c., the workhouse infirmary for lighting. Specification, &c., from Mr. A. Hurst, Clerk, Guardians' Offices, Avenue House.

Edinburgh.—The Parish Council invite contractors to tender for an installation of telephones throughout Craiglockhart Poorhouse. Mr. R. M. Cameron, architect, 53, Great King Street, Edinburgh.

France.—October 6th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for 30 Hughes telegraph instruments without base or regulator.

Halifax.—October 14th. Concrete dam, pump house, &c., at the electricity works. Mr. James Lord, borough engineer, Town Hall. Deposit, £5.

Ilkley.—October 6th. (Sec. 1) Prime-movers; (2) station equipment; (3) cables and distribution; (4) overhead travelling crane. See "Official Notices" September 12th.

Leicester.—October 7th. Car repairing shops for the Corporation tramway department. Mr. E. G. Mawbey, borough engineer (returnable deposit of £2).

Liverpool.—October 9th. Mersey Railway Co. Electrical and general stores. Specifications, &c., from Mr. J. Shaw, general manager and secretary, Central Station, Birkenhead.

London.—Bermondsey.—October 23rd. Water softener and purifying plant at the Infirmary, Lower Road, Rotherhithe, S.E. Mr. E. Pitts-Fenton, Clerk.

L.C.C.—October 14th. 200 driving wheel centres for electric cars. Particulars from Chief Officer, 62, Finsbury Pavement, E.C.

Manchester.—October 21st. The Tramways Committee invites tenders for the supply of the following:—(*a*) Permanent way special track work; (*b*) permanent way points, tongues and hardened steel centres; (*c*) granite setts. Mr. J. M. McElroy, general manager, 55, Piccadilly, Manchester.

Middleton.—October 6th. Steam coal, for a year, for the Corporation electricity works. Mr. S. Pauls, electrical engineer.

New Zealand.—December 18th. Hastings Borough Council. Two sets of high-lift turbo pumps and electric motors. Mr. H. W. Climie engineer. Specification may be seen at Board of Trade Com. Int. Department in London.

Rochdale.—October 13th. Mechanical filtration work, including turbine or water motor, &c.; also electric lighting plant. Specifications, &c., from Mr. F. H. Brunt, engineer and manager, Waterworks Office, Lord Street. Deposit £3 3s.

South Africa.—Johannesburg.—November 24th. Electric light fittings for the Town Hall and Municipal Buildings. See "Official Notices" September 26th.

South Shields.—October 15th. Corporation. One 2,000-KW. turbine, direct coupled to two three-phase generators in tandem, together with condensing plant, rotary converters, transformers and switchgear, &c. See "Official Notices" September 26th.

October 25th.—Corporation. Five or ten top-covered tramcars complete. See "Official Notices" September 26th.

Spain.—October 13th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the construction and working of a telephone exchange in the town of Algeciras, near Gibraltar. The concession will cover a radius of 9½ miles, and will be for an initial period of 15 years.

The municipal authorities of Casa de Uceda (province of Valencia) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

(*Continued on page* 544.)

The Electric Truck: English Experiments and American Practice.

ALTHOUGH the electric battery vehicle is no stranger to this country, it is an actual, though regrettable, fact, that its practical development along commercial lines is mainly due to American enterprise and ability.

Looking back through the files of the ELECTRICAL REVIEW to 1885, when battery-driven tramway cars were being experimentally run on both the North and South Metropolitan tramways,* one begins to realise how numerous have been the efforts of engineers in this country, in America, and on the Continent, to produce satisfactory battery-driven vehicles of one kind or another.

In this country the names of Elieson and Reckenzaun stand out prominently in this early work; indeed, the latter introduced a specially light motor, and an electrical method of speed regulation which was subsequently copied by Sprague and others; also, in 1883, he found a suitable worm-gearing after a lengthy investigation of the subject of driving gears.

* ELEC. REV., April 4th, 1885; November 7th, 1885.

Later, in 1887, there came Volk's electric dog-cart,* built at Brighton, and equipped with a ½-H.P. Immisch motor, "Reinold's" chain drive and E.P.S. battery, with which valuable tractive data were obtained; and in the following year† we illustrated an Immisch electric dog-cart built by the same people for the Sultan of Turkey. Mention may also be made of a three-wheeled battery car produced by the Rover Co., of Coventry, in the same year, and of the Radcliffe Ward electric omnibus‡ tried on the roads in 1889.

In 1896, after the passing of the Light Locomotive Act, which first made practically possible the use of motor-cars on public roads, the London Electrical Cab Co. was formed to run some 200 battery-driven cabs§ in the Metropolis, and our issues for the latter half of the year 1897 show that the electrical carriage was, if anything, even more conspicuous in the London streets then than now—indeed,

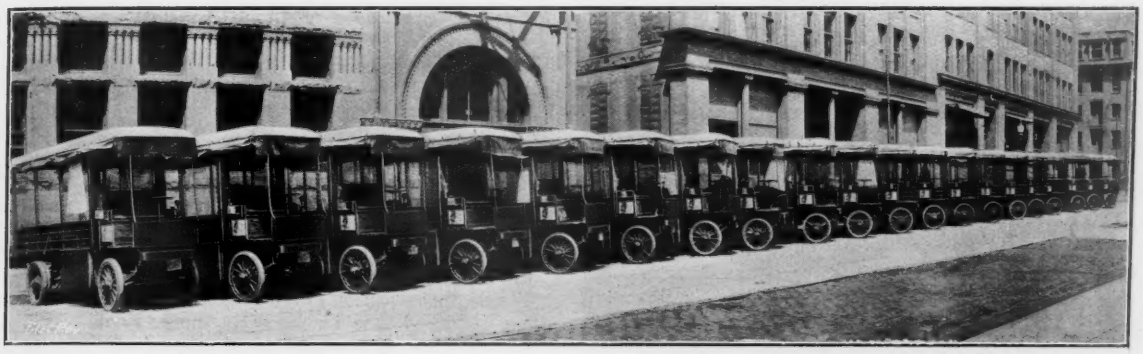

FIG. 1.—A GROUP OF "GENERAL VEHICLE" TRUCKS SUPPLIED TO THE AMERICAN EXPRESS CO.

FIG. 2.—A COUPLE-GEAR TRUCK USED BY THE METROPOLITAN COAL CO., BOSTON.

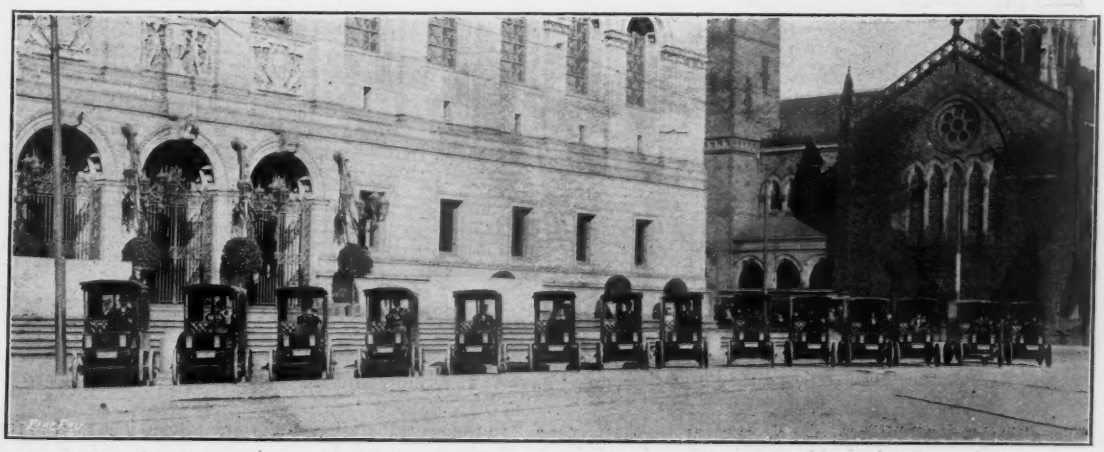

FIG. 3.—GROUP OF "GENERAL VEHICLE" TRUCKS FORMING PART OF THE LARGE FLEET OF THE BOSTON EDISON CO.

* ELEC. REV., Dec. 30th, 1887. † ELEC. REV., Sept. 21st, 1888.
‡ ELEC. REV., Aug. 25th, 1889. § ELEC. REV., Aug. 27th, 1897.

amongst others, we illustrated* a Headland electric carriage which took part in the Lord Mayor's Show of that year. In the following year we referred to an American "electric," the Ricker phaeton, exhibited at the Agricultural Hall, which was probably one of the earliest trans-Atlantic representatives to be shown in this country.

It was not, however, until 1903, when the Crystal Palace Motor Show† was first held, that American vehicle-makers, or their English agents, really attempted to impress the British

Fig 4.—Electric Brougham.

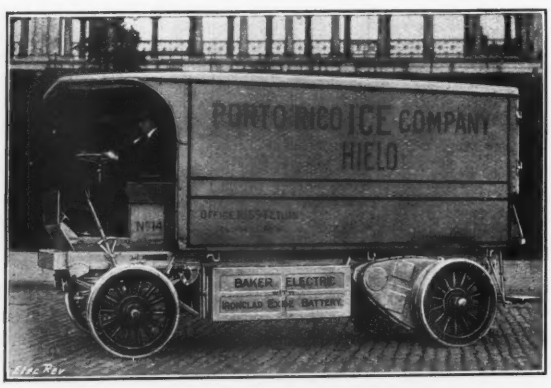

Fig. 5.—3½-ton Insulated Ice Truck, Porto Rico Ice Co.

pleasure car; the commercial vehicle and heavy truck, which has found such a wide sphere of usefulness in the States, has been unaccountably neglected, even in circumstances which would have favoured its use. In mentioning this, we, of course, have not forgotten the ill-fated Electrobus venture of recent times, which came to grief largely through financial difficulties; these vehicles were certainly of the heavy type, but they were not comparable to the electric wagon of up to 5 tons carrying capacity, which is proving so successful in the States, and will, doubtless, do equally satisfactory service in this country in the near future.

In comparison with what has been done in this country, it is interesting to notice that even so far back as 1898 and 1899 there were a few commercial electrics in use in the States, and several 1899 1,000-lb. wagons are still in use. Many 10-year-old electric trucks are in use in the States, and these constitute one of the most convincing arguments which could be found as to the reliability of such vehicles for goods transport. Unfortunately, in this country, owing to the apathy of those who either could not, or would not, take any practical step towards the introduction of the electric truck—the first important step in this direction was the adoption of the Ayton resolution at the Municipal Electrical Convention in June last—we cannot point to any commercial electric truck running under English conditions with even as many months' use to its credit as the Americans have years.

It is, in fact, necessary to turn to the United States if we are to obtain any real idea as to the possible scope for the "electric" in commercial service—the branch of the business in which there is a future full of promise, particularly

Fig. 7.—2-ton Truck used by Mitsui Co., of Tokio.

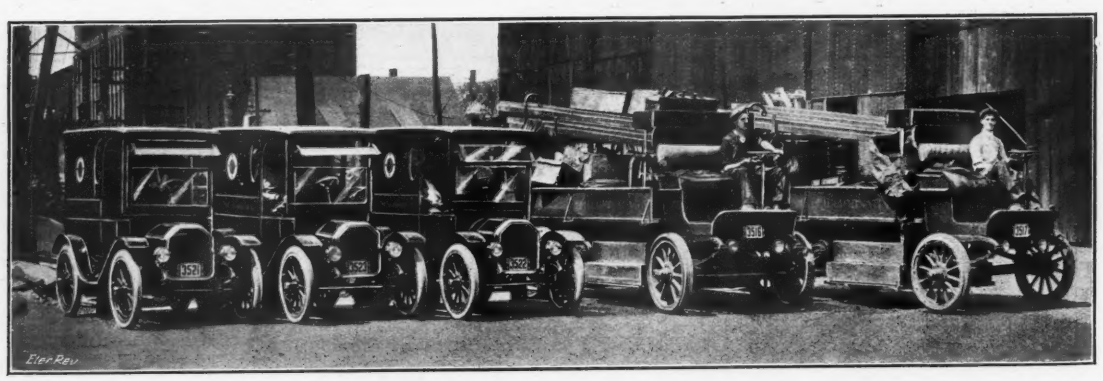

Fig. 6.—Some Trucks used by the Cleveland Electric Illuminating Co.

Figs. 4—7.—Typical "Baker" Electric Vehicles.

public with the possibilities of the electric car, and reference to our pages shows that both this and the succeeding Palace shows contained representative examples of both American and English electric vehicles.

With later developments our readers are probably familiar, but it noteworthy that even up to quite recent times attention in this country seems to have been riveted on the to the central-station engineer. Some idea of the range of business covered by the commercial electric truck in the States can be gathered from the accompanying illustrations. It should be noted that, economically speaking, the electric truck is specially adapted to short-haul frequent-stop work; it is not intended for high-speed work, but is stated to be the most economical method of road transportation where heavy loads and moderate speeds are concerned. It has, moreover, inherent advantages which may lead to its adoption

* Elec. Rev., November 12th, 1897.
† Elec. Rev., February 6th, 1903.

for purposes in connection with which it may appear at first sight to be the more costly method.

It is necessary to emphasise the fact, which experience in the States has proved, that comparison with the petrol truck proves little or nothing, as each type of vehicle has its own special and peculiar field, and though both may accomplish the same work, the electric vehicle is by far the more economical in some classes of work, just as the same may be said of the petrol truck, in other classes of work. Under American conditions, experience shows that in about 80 per cent. of the cases where trucks are used for city work, the electric truck is the more economical.

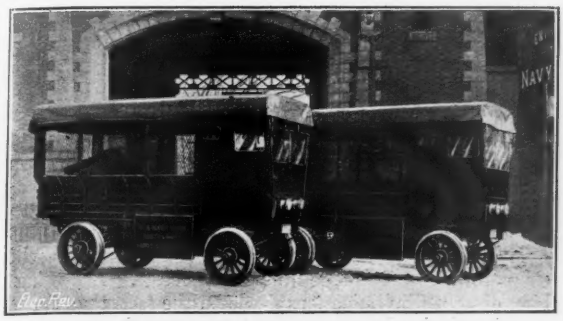

Fig. 8.—Two Examples of numerous G.V. Trucks used by U.S. War Department.

Fig. 9.—2-ton Electric Hose Wagon, General Electric Co.'s Fire Department.

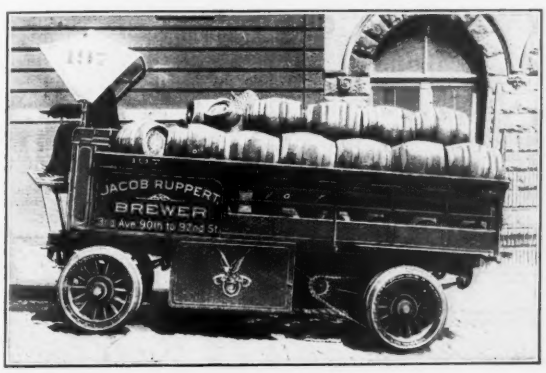

Fig. 10.—5-ton Brewery Truck on Grade; 112 G.V. Trucks used by Firm.

Fig. 11.—3½-ton Truck in Gas and Electricity Service.

Figs. 8—11.—Typical "General Vehicle" Electric Trucks.

Commercial vehicles are usually equipped with batteries to give 50 to 65 miles running on a single charge, and on a 10-hour day when allowance is made for time expended in loading and unloading, and for traffic delays in the streets, this mileage is usually ample; it can, however, obviously be exceeded if reserve batteries are provided or by boosting the battery at some convenient time.

To quote an example of the handling of such trucks, the following, culled from the *Electrical World*, is worth noting:—

Five 5-ton electric trucks manufactured by the General Vehicle Co., of Chicago, have been purchased by the Manhattan Brewing Co., of Chicago, at different times during the past few months. It is reported that these trucks have been performing work away beyond what they are expected to do. On August 4th one of the 5-ton trucks was driven to South Chicago with a load of 33 barrels and two half-barrels, having a total weight of about 6·5 tons. After delivering its load the truck returned to the brewery for a second load, taking out 29 full barrels and eight half-barrels. After conveying this load to its destination, the batteries received a 30-minute boost, and directly after luncheon a third load of 33 full barrels was delivered. The total deliveries for the day with this truck amounted to 100 full barrels, a total weight of approximately 40,000 lb., or 20 tons. The total mileage for the three trips was 64·3 miles, and the reading of the ampere-hour meter at the end of the day's work showed 70 ampere-hours left in the battery, which represents approximately 7 miles of travel. This performance is considered quite remarkable for a 5 ton electric truck, as it shows that it is able to do the work that was formerly considered strictly in the field of gasoline vehicles. All of these trucks are equipped with Edison storage batteries.

Fig. 12.—Detroit Electric 'Bus for 10 Passengers.

Fig. 13.—12-ton Electric Tractor and Coal Trailer used by Power Co.

Figs. 12 and 13.—Two Examples of the "Detroit Electric" Vehicles (Anderson Electric Car Co.).

Experience has shown that the electric vehicle is capable of keeping on the road 90 per cent. of the time, allowing a balance of 10 per cent. for repairing and overhauling. Such excellent results are attributable to its simple construction, and to the simplicity of its operation.

According to data supplied by the Atlantic Vehicle Co., it is customary with lead-acid batteries to use for a 1-ton vehicle, 44 cells of 11, 13 or 15 plates, weight not to exceed 1,760 lb., or 60 cells of Edison A-6 battery, which weigh approximately 1,260 lb. In a 2-ton truck, 44 cells of 15, 17 or 19 plates, weight not to exceed 2,300 lb., or 50 cells of Edison A-8 battery, which weigh approximately 1,800 lb. In a 3½-ton truck, 44 cells of 17, 21 or 25 plates, weight not to exceed 2,790 lb., or 60 cells of A-10 Edison battery, weighing approximately 2,250 lb. In a 5-ton truck, 44 cells of 19, 21, 25 or 29 plates, weight not to exceed 3,270 lb., or 60 cells of Edison A-12 battery, weighing approximately 2,700 lb. It is practicable when occasion demands it, to utilise the battery equipment of a 5-ton vehicle in a 3½-ton vehicle, but this is an exceptional case.

According to the size of battery, from 13 to 23 KW.-hours will represent a full charge in the case of a 1-ton truck; 19 to 33 KW.-hours for a 2-ton truck; 25 to 39 KW.-hours for a 3½-ton truck; and 29 to 49 KW.-hours in the case of a 5-ton vehicle, the figures being for lead batteries, while the nickel-iron battery requires possibly 20 per cent. more charging energy.

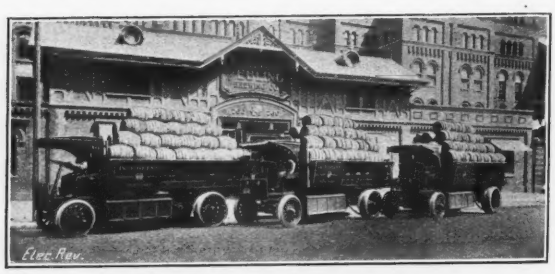

FIG. 14.—5-TON ELECTRIC TRUCKS OF THE EBLING BREWING CO.

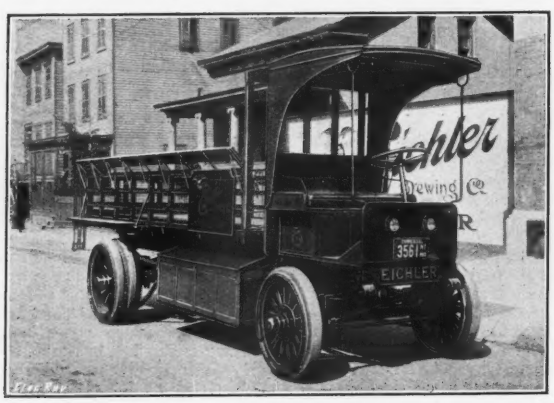

FIG. 15.—AN ATLANTIC 5-TONNER END ON.

TEST NO. 2.

Total number of stops	24
Distance between stops	·42 of a mile.
Duration of stop	1 minute.

Course triangular; road conditions good.

	Average speed M.P.H. Elec.	Petrol.
Leg 1 Level	11·4	10·08
Leg 2 Up	6·9	7·83
Leg 3 Down	11·8	10·56
Test No. 1 average	9·65	8·48
Test No. 2 average	10·03	9·48
General average speed	9·84	8·98

It must be noted that the electric vehicle shows a general average speed nearly 10 per cent. greater than in the case of the petrol vehicle, although the latter was geared to a 50 per cent. higher speed.

Mr. Thompson states further that the electrical machine shows to better advantage in operating costs. According to him, extended investigations disclosed the fact that for the electric vehicle the average cost per car-mile for maintenance increased only 13⅓ per cent. over a period of four years, while that for the petrol vehicle increased 362½ per cent. in the same time; moreover, at the end of the four-year period the maintenance cost for the electric was less than 50 per cent. of that of the petrol vehicle.

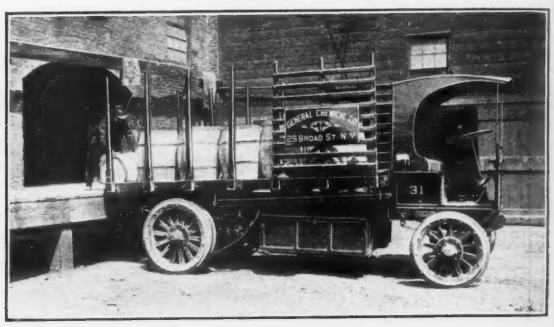

FIG. 16.—3½-TON TRUCK IN USE BY CHEMICAL CO.

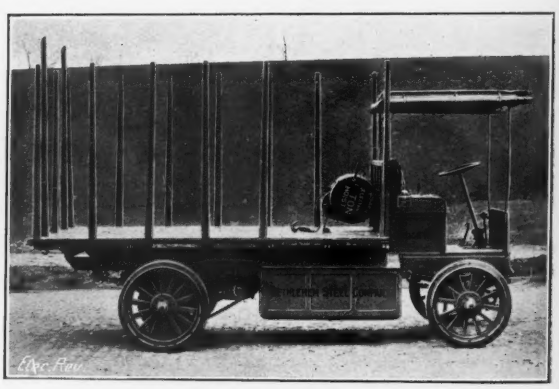

FIG. 17.—2-TON ELECTRIC TRUCK WITH HOIST; BETHLEHEM STEEL CO.

FIGS. 14—17.—TYPICAL TRUCKS OF THE ATLANTIC VEHICLE CO.

The number of lead or iron cells employed is suited to the usual American line voltage (115 volts). The speeds of such vehicles as those mentioned above vary from 12-14 miles an hour for the 1-ton, to 7-9 miles an hour for the 5-ton truck.

These speeds, although moderate, often represent faster travelling in city streets where stops are numerous, than in the case of the petrol truck. Mr. Stephen G. Thompson, writing in the *Central Station*, gives the following comparative data obtained on test under identical conditions. The electric vehicle was geared to a maximum speed of 12 miles per hour; the petrol to 18 M.P.H. :—

TEST NO. 1.

Total number of stops	24
Distance between stops	·42 of a mile.
Duration of stop	2 minutes.

Course triangular; road conditions good.

	Average speed M.P.H. Elec.	Petrol.
Leg 1 Level	10·76	9·41
Leg 2 Up	7·08	8·85
Leg 3 Down	11·12	7·20

The exact figures derived from the records of the operators, and including all items chargable to replacement of mechanical parts, storage batteries and tires, are as follows :—

	No. of machines reported.	Average maintenance cost after 7 months' operation.	Average maintenance cost after 48 months' operation.
Petrol	54	4 c.	18 c.
Electric	69	7·5	8·5

This result is easily understood in view of the simplicity of the electrical machine in comparison with its petrol-driven competitor; and that this is appreciated in America is shown by the number of large electric vehicle installations, and the fact that fewer than 10 active electric vehicle manufacturers are supplying over 20 per cent. of the total number of commercial power wagons employed, and this in competition with over 300 makers of petrol trucks.

Readers who desire to delve more deeply into the subject of the electric vehicle generally, cannot do better than read the bulky paper contributed by Messrs. Watson and Mitchell to the proceedings of the last Municipal Electrical Convention*, which contains very complete data and estimates relating to modern electric vehicle practice.

Our first illustration of a batch of the American Express Co.'s electric delivery trucks is sufficiently impressive, but it shows a few only out of the hundreds of similar vehicles employed by this company, and other concerns in the same business, as, for instance, the Adams Express Co., are equally prominent users. The latter company depends upon the "electric" almost entirely in eleven cities in the States, and is reported to be the largest individual user of electric vehicles in the country.

Our second view shows an entirely different adaptation of the battery vehicle, namely, for coal haulage—the arrangement, known as the couple-gear, has already been referred to in our pages—and, generally, the various views illustrate the great variety of service to which electric battery propulsion has been applied in the States.

In passing, it will be noted that fig. 6 shows some of the Cleveland Electric Illuminating Co.'s Baker trucks. The two larger trucks are used on general line-construction work and are each equipped with duplicate batteries, as they are often in use both day and night. They operate over a radius of 30 to 35 miles, and during 11 months of 1912 were in use every working day and 18 Sundays.

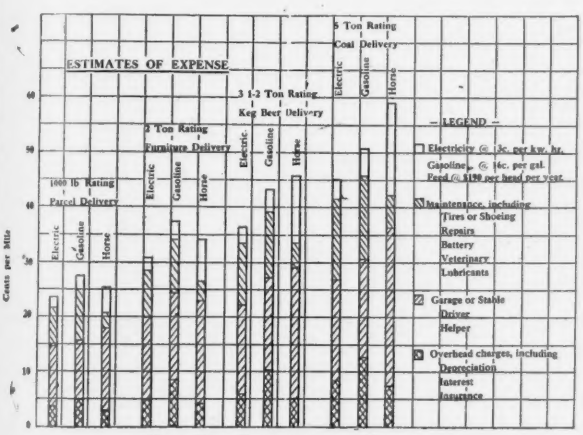

FIG. 18.—COMPARATIVE COSTS.

Fig. 7 shows a Baker truck in Japan, used for hauling charcoal. This firm's vehicles have also been supplied to the Sao Paulo Co., Brazil; the Siam Electric Co., of Bangkok; and the Richardson & Orr Co., of Melbourne, showing that the electric is finding a place in many far-away countries, where the conditions are certainly not better than in Great Britain.

Fortunately for the vehicle manufacturers in the States, the central-station authorities there were ready to co-operate in the movement, and did so, in some cases, before there was any proof of its practical utility.

To-day there is nothing left to be proved; the station engineers have obtained a vehicle load, and it is the most profitable one, in many cases, that they possess. It comes on at night, reaching its maximum about midnight; and it requires scarcely any extra station equipment. As an example, the Denver Gas and Electric Co., which serves the City of Denver (comparable to, say, Leeds or Bristol) during the last year obtained a gross revenue from vehicle charging of $70,000; we have on previous occasions quoted other equally striking figures for American cities.

A question which, perhaps, in this country presents some difficulty is the absence of reliable cost data for operation. Messrs. Watson and Mitchell endeavoured to meet this difficulty in their recent paper, giving estimates based on English conditions, and, as a number of electrics are now on order in the London area, it will soon be possible to quote actual data.

In America the question of operating costs was tackled by the Massachusetts Institute of Technology, which is one of the first engineering colleges in the States. The Institute's figures, which relate to comparative costs of horse, petrol and electric trucking, show that while the horse is cheaper for the lighter loads than the petrol truck, the latter is cheaper for heavier loads, but the electric truck is cheaper than either. The *Scientific American* in January of this year published a diagram showing graphically the results obtained from this investigation, and we reproduce it in fig. 18.

It is pointed out, however, that the figures refer to "horse distances"; the petrol truck has a field of its own where long distances, such as 100 miles a day, are concerned.

During the first seven months of the present year no fewer than 271 new electric industrial vehicles were put into service in Greater New York, bringing the total up to the respectable figure of 2,151, a number which represents 40 per cent. of the commercial motor vehicles of all kinds in use in that important centre. The load which this must bring to the electricity supply companies can be no mean one. That the electric delivery vehicle is by no means restricted in its use is evidenced by the statement that in the district referred to it is being employed in 76 different lines of business. Brewers lead the way with a total of 322; then come the department stores, with 262; parcels delivery companies, with 197; bakers, with 154; and the electricity supply authorities themselves are utilising 127 vehicles in different departments, thus practising what they preach, and demonstrating that the electrically-propelled vehicle forms a thoroughly practical, efficient and economical machine for certain classes of delivery work.

In conclusion, we may add that if the electric vehicle has not progressed in this country as it should have done, it is certainly not due to any lack of attention on the part of the electrical Press. We ourselves have frequently referred to it,* and urged its claims on the central-station engineer, its suitability for English city work, and more particularly the splendid field open to it in the huge mileage of streets in the London area.

Nothing succeeds like success!—and it must be admitted that our American friends deserve all the success which has attended their efforts. To some of them, viz., the General Vehicle Co., of Long Island City, N.Y.; the Atlantic Vehicle Co., of Newark, N.J.; the Anderson Electric Car Co., of Detroit, Michigan, and the Baker Vehicle Co., of Cleveland, Ohio, we are indebted for the representative illustrations which accompany this article.

In a later issue we shall deal with the progress that can now be recorded in this country.

The 25 Club.—We learn from Mr. J. G. Lorrain, the hon. secretary, that the next dinner of the above club will be held at the Connaught Rooms, Great Queen Street, Kingsway, W.C., at 7.15 for 7.30 o'clock on Wednesday, October 22nd.

Gas Publicity.—Powder and Shot.—At Preston on Saturday morning five persons were found unconscious through gas poisoning, viz., Mary Bushall (52), of 314, New Hall Lane, her three sons and her mother. The mother and sons failed to appear at work at the mill, and the mill authorities sent messengers to their house. The house was found full of gas, and the five occupants were unconscious, suffering from gas poisoning. Two of them were removed to the infirmary in a critical condition, and the others were attended at a neighbour's house. Gas superintendent Boast was summoned, and found a defective plate in the gas meter which had given way. At an inquest on Mary Heyhurst (79), of 367, Glossop Road, Sheffield, who was found dead in her bedroom, which was full of gas, the deceased's daughter said she thought her mother had got up as usual to turn off the gas in the early morning, and after turning off the tap the sleeve of her nightdress had caught the tap and turned it on a little. The tap was easily turned, and when the discovery was made it was found to be turned on. The verdict was "Accidentally suffocated by coal gas," and that deceased had "probably inadvertently turned on the gas tap after turning it off."

Miners' Lamps.—A correspondent says: "The management at one of the pits of the Kinneil Collieries, West Lothian, has been lately conducting tests with a variety of electric safety lamps, and these have given so much satisfaction that the miners are very desirous of getting the colliery company to introduce them, and this has led to a strike.

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* ELEC. REV., July 4th, 1913.

* A few of the principal articles appeared as follows:—ELEC. REV., August 27th, 1909; October 22nd, 1909; October 28th, 1910; November 10th, 1911; January 26th, 1912: July 11th and 18th, August 8th, 15th and 28th, 1913.

CONTRACTS OPEN.

(*Continued from page* 538.)

Sweden.—October 8th. Accumulator battery for Stockholm. Tenders to Förestandaren for Kungl, Vattenfallsstyrelsens Elektrotekniska Byra, Stockholm. Specification may be seen at Board of Trade Com. Int. Department in London.

Swindon.—G.W. Railway.—October 13th. One year's supply of stores, including a number of electrical and telegraph supplies. See "Official Notices" to-day.

Walthamstow.—October 8th. L.T. feeder cable for the Electricity Department. See "Official Notices" September 19th.

Warrington.—October 14th. Corporation. (1) Low-tension cable; (2) low-tension feeder panel. See "Official Notices" September 26th.

CLOSED.

Argentina.—On July 22nd the Government called for tenders for a 300-H.P. motor and 215-KW. generator, a 10-ton traverser, switchboard, cables, &c., for the electric power house at Campo de Mayo. A tender has been accepted for the sum of $89,218.

Austria.—The Austrian Bergmann Electrical Co., of Vienna, has secured a contract for the establishment of a central electric lighting station in the town of Hermagor, Corinthia.

Barking.—The U.D.C. has accepted the quotation of Messrs. Marryat & Place to carry out repairs to the No. 1 generator (the armature of which was burnt out some time ago), at a cost of £38, plus cost of extra copper and carriage.

Battle.—The B. of G. has received the following tenders for the installation of the electric light at the workhouse, and has referred the four lowest to a committee, with power to accept:—

Safety Light Co., Ltd.	£511
Messrs. Russell	445
Page & Miles	433
Squirrell & Co.	374
Bruce & Co.	365
Newbald & Co.	320
Mr. J. L. French	315

Belgium.—Three German, one French and three Belgian concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of six lots of copper wire; the Rheydt Kabelwerk, of Rheydt, Germany, submitted the lowest tender for four of the lots totalling 27½ tons, and the Société des Usines à Cuivre, of Liége, for two lots (65 tons).

Bexley.—The U.D.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for a motor-generator, at £320.

Bristol.—The Electrical Committee has entered into a contract with the Bedminster, Easton Kingswood and Parkfield Collieries, Ltd., for the supply of coal to the Avonbanks works for 12 months, at an estimated cost of £16,675.

The Docks Committee of the T.C. has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for triple-concentric cable.

China.—The Western Electric Co., of Chicago, has a contract in hand for the establishment of a telephone exchange in the city of Tientsin; it will be equipped for about 4,000 subscribers and have a capacity of 14,000 lines.

Dartford.—The B. of G. has received the following tenders for the electric light installation at the workhouse infirmaries:—

W. Dickinson & Co., Bexley Heath	(accepted)	£96
Mr. E. E. Beaven, Dartford		120
S. W. Gibson & Co., Dartford		103
Mr. W. Bayliss, Dartford		148

Derby.—The E.L. Committee of the T.C. has accepted the following tenders:—

British Thomson-Houston Co., Ltd.—Switchgear, £943.
Simkiss & Knighton.—Cast-iron piping for turbine, £246.
Aiton & Co.—Steel piping for turbine, £142.
Newton Bros.—Balancer, £179.

Dublin.—On the report and recommendation of Mr. Ruddle, the Electric Supply Committee has accepted the tender of the General Electric Co. for a supply of both single and three-phase meters for a period of two years.

East Ham.—The tender of the James Keith & Blackman Co., Ltd., has been accepted by East Ham T.C., at £231 10s., for forced-draught fans, motors, &c., at the refuse destructor works. The tender of Messrs. G. Weston & Sons, Ltd., has also been accepted, at £173, for wiring the new fire station and firemen's dwellings. Tenders were also received from Messrs. A. Newman, Ltd., Ray Electric Co., and F. Hodgson & Co.

Fleetwood.—The contract for the electrical installation at Victoria House, Lord Street, which has been taken over by the Royal National Mission to Deep Sea Fishermen, has been secured by Mr. R. Barrow, of Fleetwood.

Kingston-on-Thames.—The T.C. has accepted the tender of the Rees Roturbo Co. for an electrically-driven pump for the sewage works, at £191.

London.—L.C.C.—The following is a list of the tenders received for installing the electric light at the Tollit Street Special School, Mile End:—

G. E. Taylor & Co.	(accepted)	£378
E. Lawrance & Sons, Ltd.		380
Wells, Raynor & Co.		380
Cunningham, Ltd.		398
H. J. Cash & Co., Ltd.		414
C. H. Cathcart & Co.		415
Pinching & Walton		434
A. Newman, Ltd.		449

Poplar.—The following tenders have been received by the B.C. for the provision of plant for electricity works extensions:—

Additional ash elevator:—

James Harvey	(accepted)	£300
Geo. Robson & Co.		371
New Conveyor Co.		517
Spencer & Co.		578

Steam, feed and blow-down piping:—

Babcock & Wilcox, Ltd.	(accepted)	£325
John Wilson & Co., Ltd. (no detailed specification)		306
Edward Le Bas & Co.		336

Girders for boiler foundations:—

Fairweather & Ranger	(accepted)	£83
Peirson & Co.		79
Redpath, Brown & Co.		96

Switchgear in connection with 1,000-KW. converter at Millwall sub-station:—

General Electric Co.	(accepted)	£257
British Westinghouse Co.		367
Johnson & Phillips, Ltd.		422
Ferranti, Ltd.		397

Wet air filters for two 3,000-KW. turbo-alternators:—

Sturtevant Engineering Co.	(accepted)	£407
Balcke & Co.		408
Heenan & Froude		589

St. Pancras.—The tender of Messrs. Spagnoletti, Ltd., has been accepted by the Guardians, at £269, for converting the present lift in the Infirmary into an electrically-driven one. Tenders were also received from Messrs. R. Waygood & Co., Ltd., at £370, and Medway's Lift Co, at £287.

Stepney.—The B.C. Electricity Committee is ordering six arc lamp columns from Messrs. R. A. Bradshaw & Son, at £9 15s. each.

Southampton.—The tender of Messrs. Babcock & Wilcox, Ltd., has been accepted by the T.C., at £1,661, for a boiler, superheater and mechanical stoker at the electricity works.

Walthamstow.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., at £200, for the supply of 550 yd. of three-core low-tension cable. Other tenders were received from Callender's Cable and Construction Co., Ltd., Messrs. Johnson & Phillips, Ltd., Messrs. Siemens Bros. & Co., Ltd., Union Cable Co., Ltd., and the Western Electric Co., Ltd.

Wimbledon.—The T.C. has accepted the following tenders:—

British Thomson-Houston Co., Ltd.—1,500-KW. turbo-alternator, with condensing plant, pipework and auxiliaries, £8,711.
Herbert Morris, Ltd.—Overhead travelling crane, £258.
British Electric Transformer Co., Ltd.—One 75-KW. and one 50-KW. electric transformers, £123.
Arc Lamp and Engineering Co., Ltd.—500 metallic-filament lamps.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday October 3rd. At 39, Victoria Street, Westminster. Lecture on "Gas Engine Testing," by W. A. Tookey.
Friday, October 10th. At 6.30 p.m. Visit to the Model Engineer Exhibition at the Royal Horticultural Hall.

Salford Technical and Engineering Association.—Saturday, October 4th. At the Royal Technical Institute. At 7 p.m. Lecture on "Automobile Construction," by Mr. J. A. Mackie, B. Eng.

Institute of Marine Engineers.—Monday, October 6th. At the Institute, Romford Road, E. At 8 p.m. Paper on "Fuel Gas Analysis and its Advantages," by Mr. A. E. Jones.

Society of Engineers.—Monday, October 6th. At 7.30 p.m. At the Institution of Electrical Engineers. A paper entitled "Highways" will be read by Mr. C. H. Cooper, M.Inst.C.E.

Batti-Wallahs' Society.—London. Wednesday, October 8th. Informal evening.

Association of Engineers-in-Charge.—Wednesday, October 8th. At 8 p.m. At St. Bride's Institute. Presidential address by Dr. R. T. Glazebrook, F.R.S.

Institution of Automobile Engineers.—Wednesday, October 8th. In London. Presidential address by J. S. Critchley. Discussion on "The Fuel Question."

Inquiries.—A correspondent asks who are the makers of the "Restler" enclosed high-speed engine, and where he can see one working; one that he has gets very hot after three hours' run. Makers of floor shaving or planing machines are asked for.

Electrical Fatality.—According to a newspaper report, Levy Dell, a labourer employed on the new sea defence works at Southend-on-Sea, attempted to pick up a live electric wire which had fallen from a post, on 26th ult., and was instantly killed.

NOTES.

The Effect of Outer Globes on the Life of Metal-Filament Lamps.—Under the above heading we called attention in our issue of September 19th to the experiments carried out by a Swedish engineer (Herr Sunden), the conclusions of which investigations were:—That the life of a metal-filament lamp was shortened and its efficiency impaired by over-heating; and that a device should be employed for using metal-filament lamps without globes or shades.

The first of these conclusions, which is in accordance with experience derived from other sources, may be accepted without question. It has been pointed out to us, however, by the General Electric Co., Ltd., that Herr Sunden's second conclusion is quite erroneous. That company has inaugurated an illuminating engineering department with a testing laboratory equipped with all the necessary apparatus, and some specially designed for the study of scientific illumination, and the subsequent design and manufacture of the necessary appliances to give effect to the study work. The company points out, quite rightly, that a bare metal-filament lamp for either indoor or outdoor use is almost intolerable. More or less eye strain, due to the glare, is inevitable, and the loss of illumination due to the light rays not being redirected to their useful channel not only means a considerable loss of efficiency, but also that a lamp of much higher consumption is being used than would be necessary with a suitable reflector or diffusing globe.

After a long period of experiment and test, the General Electric Co., Ltd., has produced a glassware whose efficiency and low absorption qualities are, it is claimed, unique. Whether the company's claim, that this glassware is a great advance on anything of the sort so far produced, will be proved in practice remains to be seen; but, apart from its other qualities, there is no question as to its entirely overcoming Herr Sunden's objection. Both the shades and the globes are suspended from galleries specially designed to give efficient ventilation, which entirely disposes of the "over-heating" difficulty with metal-filament lamps. Granted that the sizes of the ventilation orifices in the gallery are sufficient, the power of the lamp is of small consequence, as the greater the heat generated the greater will be the current of air cooling the lamp.

Association of Electrical (Station) Engineers.—An open general meeting of the London Section was held at Chandos Hall, W.C., September 24th, at which there was a very good attendance. The subject down for discussion was "A Fighting Policy" (Mr. W. A. Jones in the chair). The discussion was opened by a member of the London Committee, who outlined the reasons for forming the Association, for the benefit of those who had not previously attended a meeting; he also pointed out the two methods by which the objects of the Association might be attained, which could be summarised as a passive and an active or fighting policy. He then proceeded to show the value of a fighting policy on the principle of the "power behind," to compel those employers who had taken advantage of the lack of organisation to consider the grievances of their employés.

A speaker, on behalf of the passive policy, suggested that the Association should endeavour to obtain the assistance of chief engineers and get them to take a personal interest in the welfare of the station engineers.

The next speaker's policy was "No quarter." He emphatically stated that he believed in a fight to the finish as the only possible remedy for the existing evils.

Another speaker said that force was the predominant feature of existence, and that the station engineer controlled the greatest force of modern times, and had a great power over the community generally. He also said that efforts should be made to compel corporations, &c., to pay their chief engineers adequate salaries to prevent their having to take premium pupils to augment their income. The meeting was forcibly reminded by another speaker, amongst other things, that while engaged in the design, erection, manufacture, and running of all kinds of electrical apparatus, the majority of those engaged in the industry had to go home to 1d. in the slot gas.

Resolutions were put to the meeting asking for the endorsement of a "fighting" or active policy, which were carried by large majorities.

A resolution was put to the meeting with regard to co-operation with other organisations for mutual benefit. The chairman ruled this resolution out of order, but stated that the matter would have the consideration of the committee.

The discussions *re* the fighting policy have aroused considerable interest, and have created such a record in attendance that it has been decided to hold further meetings to discuss details. The next meeting will be held as above, on Tuesday, October 28th.

A meeting of the Bradford Section was held at the Mechanics' Institute, September 25th, Mr. R. P. Spurr in the chair. The delegate to the Conference submitted his report and the rules, which were approved. A resolution was put to the meeting (after a good discussion), asking if they would endorse the fact that the Association was a fighting organisation, and was carried unanimously. Owing to the scattered nature of the district comprising the Bradford Section, it was decided to hold meetings in other towns besides Bradford. The next meeting will be held at Leeds in about a month's time; the exact date will be advertised.

A meeting was held recently at Liverpool, at which Mr. A. C. Black resigned his position as hon. secretary (Liverpool Section), owing to the fact that he was shortly leaving the district. The meeting accepted his resignation with regret, and appointed Mr. F. C. Taylor in his place.

The Batti-Wallahs' Society.—This society's programme for the 1913-14 season includes the following events:—

Wednesday, October 8th.—Informal Evening.
Friday, October 31st.—Smoking Concert.
Wednesday, November 19th.—Informal Evening.
Wednesday, December 10th.—Informal Evening.
Wednesday, January 7th, 1914.—Informal Evening.
Wednesday, February 4th.—Informal Evening.
Saturday, February 28th.—Annual Dinner.
Monday, March 9th.—Annual General Meeting.
Wednesday, April 1st.—Informal Evening.
Friday, April 24th.—Smoking Concert.

Fire on the "Imperator."—The fire which recently broke out on the *Imperator* while she was lying in New York harbour was easily extinguished and caused no widespread damage. Nevertheless, the incident attracted much attention in the European and American daily papers, and editorial notes and comments have been followed by the usual flood of correspondence. The Hamburg-American Co. has since published a statement in which the outbreak is attributed to a short circuit in one of the electric motors driving the air-cooling plant. If this diagnosis is correct, says the *E.T.Z.*, the fault may be due to *force majeure*, or to neglect of the V.D.E. rules either in the installation or operation of the machine. The importance of the matter requires the closest investigation to be made in order that the mishap may not recur, and in order that public uneasiness may be allayed.

Mrs. Williams: Charge Engineer.—We do not know whether Mrs. Lena Williams, of Cookshire, in Canada, has read the recent correspondence in our pages respecting "Women in Power Stations," but we have no doubt that she would be able to write very entertainingly respecting the views of some of our correspondents, for we read the following in the *Canadian Electrical News* just to hand:—

"Mr. H. A. Worby, manager of the Westbury Electric Light and Power Co., Cookshire, P.Q., is particularly fortunate in his choice of operators. For the last year and a half his daughter, Mrs. Lena Williams, has taken complete charge of one shift each day with perfect satisfaction to the owner of the plant, as well as to the customers. We believe this is the only case in Canada of a lady operator of a light and power plant. Mrs. Williams . . . is the wife of Mr. Elmer Williams, power electrician of the Westbury plant."

A 30,000-KW. Steam Turbine Generator.—The Interborough Rapid Transit Co. of New York placed recently with the Westinghouse Machine Co. an order for three immense turbo-generator sets, the design of which promises to bring out some new phases of both manufacturing and operating practice. It was proposed to build the sets in two units, one generator being driven at 1,500 R.P.M. by a high-pressure turbine, the exhaust from which would be used in a low-pressure turbine driving the other generator at 750 R.P.M. The blade speeds involved in this design are low, and each turbine element is of exceedingly simple mechanical construction, involving no unusual engineering problems.

The scheme of employing two turbine elements and having the steam pass serially through them is not new. A number of such units of from 1,000 KW. to 2,000 KW. rating were built by the Westinghouse Machine Co. in 1901. This construction has again come to the front in the case of the English-built Parsons turbine ordered recently by the Commonwealth Edison Co. of Chicago. It is new, however, to employ high-pressure and low-pressure elements driving separate generators, each at a different synchronous speed.

The steam supply for these units will carry 120° superheat, and a vacuum of 29 in. will be required for operation. Under these conditions it is claimed by the manufacturer that the steam consumption of each of them will be approximately the same as that for one of the Parsons sets operating on 200° superheat and with 29·2-in. vacuum, conditions much more favourable than can be obtained for the Interborough installation.—*Electrical World.*

Tramway Workers' Combine.—The tramwaymen of Birmingham, Wolverhampton, West Bromwich, Walsall, Dudley, Wednesbury, Bilston, and South Staffordshire generally, have recently combined and formed a District Council, with the object of taking concerted, if isolated, action when any demand is made for increased wages or improved conditions of labour. The inaugural meeting was held at the Labour Assembly Rooms, Wolverhampton, on Thursday last week. Mr. Sanders, the president of the Council, in the course of an address, remarked that through organisation some wages had been increased by 80 per cent., and the hours of some reduced by from 40 to 60 per cent. As things were, they could not take a gloomy view of their position, for they had moved forward from the time when the tramway worker was once termed "the white slave of England," and was looked upon as the man who could not get work at anything else. However, by being honest, taking an interest in himself, and organising, the tramwayman's position had advanced. Mr. Carter pointed out that their Union was one of the six largest in the country. They had recently made great progress, having enrolled 5,000 members this year. He hoped that before long no one would be employed in the tramway service who was not one of them and who did not do his part towards getting benefits which he shared in through the actions of the Trade Unions.

Mr. Vaughan (Bilston) expressed his pleasure that instead of the branches having so many different programmes and policies, they would now have a united one. By this means their position would be considerably strengthened, and their applications would stand a much brighter prospect of success..

Diesel Engines at Kingston-on-Thames.—On Friday last, in the presence of a large number of residents and visitors, the Mayor of Kingston-upon-Thames formally inaugurated the new horizontal Diesel engines which Mr. J. E. Edgcome, electrical engineer to the Corporation, has installed at the electricity works. These engines were described and illustrated in our issue of June 13th last, on the occasion of the visit of the Municipal Electrical Association: we need not, therefore, here enlarge upon their special features. Suffice it to say that the proceedings were successful in all respects, and Mr. Edgcome was heartily congratulated upon the auspicious start made with the new plant. The total cost of the extensions has been about £15,000. After the ceremony and the inspection of the works, the visitors were entertained at tea by the Mayor, Mr. Councillor C. H. Burge, F.I.C.

Appointments Vacant.—Junior switchboard attendant, A.C. and D.C., for the Halifax Corporation electricity works (£1); mains superintendent for one of the areas of the Stoke-on-Trent County Borough's supply department; shift engineer (Belliss engines and Lancashire boilers) for the Colne Corporation (35s.); canvasser for lighting, cooking and power business for York Corporation (35s. + commission). Particulars are given in our advertisement pages.

Strike.—The *Daily Herald* states that on Wednesday 25 girls employed in the cotton shop of Messrs. Siemens's works at Charlton struck work, refusing to take charge of two machines each.

Institution and Lecture Notes.—Greenock Electrical Society.—We have received a copy of the syllabus of this Society for the 1913-14 session, which opens on October 3rd. Meetings are to be held on alternate Fridays at 7.45 p.m. at the Temperance Institute, West Stewart Street, Greenock. Mr. J. A. Robertson, borough electrical engineer, is hon. president, and Mr. W. A. Toppin vice-president. Mr. A. Hurry, 54, Brougham Street, is secretary. The following is a list of papers announced:—

October 3rd.—"Electricity Supply in Greenock." By J. A. Robertson.
" 17th.—"Motor-Driven Machinery." By W. A. Toppin.
" 31st.—"The Principles of the Steam Engine." By James Frew. "Boiler Inspection." By G. R. Reid.
November 14th.—"Electric Tramcar Equipment." By S. James.
" 28th.—"Steam Turbines." By J. H. Parker. "The Entz Reversible Booster." By P. Kerr.
December 12th.—"Primary Batteries." By A. Bucklitsch. "Secondary Batteries." By H. J. Roberts.
January 9th.—"Thoughts on Cable Chemistry." By Lowrie Sinclair. "Cable Faults and their Causes." By L. Hogg.
January 23rd.—"Aviation." By H. J. Roberts.
February 6th.—"Cinematograph Supplies." By W. B. Smith. "Faults in House Wiring." By W. McGibbon.
February 20th.—"Power Station Design." By J. Punch.
March 6th.—"Power Transmission." By A. Zoller.
" 20th.—"Sub-Station Equipment." By D. McDougall.

Visits have been arranged for to the Alan Kerr Technical Laboratory, Port Dundas electricity station at Glasgow, and to the works of the Clyde Valley Power Co., and a social evening is fixed for December 26th.

The Association of Engineers-in Charge.—The programme for the 1913-14 session, which opens on October 8th with the presidential address by Dr. R. T. Glazebrook, includes the following papers, and, as usual, a number of social events, such as dances, concerts, and the annual dinner (March 21st):—

November 12th.—"Wireless Telegraphy." By Capt. H. Riall Sankey.*
December 10th.—"Water Raising and Measuring." By W. H. Booth.
January 14th.—"Commercial Motors, Steam and Petrol." By D. J. Smith.
February 11th.—"Heating of Buildings by Low-Pressure and Exhaust Steam." By T. J. Couglan.
March 11th.—"Reinforced Concrete Construction." By Henry Adams.
April 8th.—"Intercommunication Telephones." By A. F. Cannon.

The meetings take place at the St. Bride's Institute, on Wednesdays, at 7.30 p.m., with the exception of *, which will be at Marconi House.

The Institution of Civil Engineers.—It is announced that the twenty-first James Forrest Lecture will be delivered in the lecture theatre of the new building of the Institution of Civil Engineers, Great George Street, Westminster, on Thursday, October 23rd, at 9 p.m., by Mr. Alexander Gracie, M.V.O., M.Inst.C.E., his subject being "Progress of Marine Construction."

University College, London.—Particulars of a course of Wednesday lectures, by Prof. J. A. Fleming, on "Conductors for the Electrical Transmission of Energy," to commence on October 29th, are given in an advertisement to-day.

Electro-Harmonic Society.—The twenty-eighth season of this society opens on October 17th (Friday) with a smoking concert in the King's Hall, Holborn Restaurant.

The Dynamicables.—The next dinner of the Dynamicables will be held at the Trocadero Restaurant on Wednesday, October 15th, at 7.30 p.m., with Mr. J. F. C. Snell in the chair

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—In our reference to the Rhondda appointment last week a slight error occurred. For Mr. James Bowman read Mr. Joseph M. Bowman. This gentleman is at present resident engineer at the Hertford electricity works of the North Metropolitan Electric Power Supply Co.

On Thursday evening, September 25th, Mr. B. Sankey entertained the staff at the Whitehaven electricity works at dinner before leaving to take up his South African post. The staff took advantage of the occasion to present their old chief with a silver cigarette case and a fountain pen. On the following day the officials of the Corporation presented him with a suit case, an attaché case, and a pair of military brushes. The Town Clerk made the presentation. Later a gold watch was presented by the Mayor on behalf of the members of the Council. It is interesting to note that this month (September) completes the twentieth year of working, the Whitehaven supply having commenced in September, 1893. During the whole of this period Ald. J. R. Musgrave has occupied the chair of the Committee. Mr. Sankey has been in charge for the last seven years.

Mr. J. Mackintosh, of East Ham, has been appointed switchboard attendant at Barking electricity works. The salary of Mr. W. E Kidner, the assistant engineer, is to be advanced by £20 per annum.

Mr. Chas. F. Wade has been appointed to the post of assistant engineer at the Southwark Borough Council's electricity works, from that of charge engineer to the Islington Borough Council.

Mr. R. H. Lee, junior charge engineer, has been appointed third senior engineer-in-charge at Islington electricity works.

Owing to the resignation of one of the shift engineers at the East Ham generating station, the junior shift engineer, Mr. D. Anderson, has been promoted to fill the vacancy.

Mr. D. C. Redfern has resigned his position as southern district mains superintendent at the Stoke-on-Trent electricity works, in order to take up an appointment with the Yorkshire Electric Power Co.

At the last meeting of the Stoke-on-Trent Borough Council, Mr. C. Cuthbertson, the resident engineer of the Longton area, was given the charge of both the Stoke and Longton Electricity Works, and Mr. W. Adams, the resident engineer of the Hanley area, was given the charge of both the Hanley works and the new central power house. The chief electrical engineer is Mr. C. H. Yeaman.

The E.L. Committee of the Derby T.C. has recommended that the salary of Mr. E. G. Boissier, mains superintendent, be increased from £200 to £220 per annum, as from August 1st last.

Tramway Officials.—At Rochdale Town Hall on September 26th the chief officials of the Corporation presented to Mr. J. S. D. Moffet (late tramways manager) a canteen of cutlery upon his removal to West Ham to take up the general managership of the Corporation tramways there. Mr. W. H. Hickson (town clerk), who presided, referred to the valuable assistance he had received from Mr. Moffet in connection with Parliamentary Bill work; and Mr. T. R. Ball (gasworks manager) made the presentation. Mr. S. S. Platt and Mr. Webster, the new tramways manager at Rochdale, also spoke.

Mr. H. J. Somerset has relinquished his position as manager and engineer of the Perth Electric Tramway Co., which has been acquired by the Government, and, according to an Australian exchange, he is on his way to England.

General.—To celebrate the occasion of his forthcoming marriage to Miss Verel, Mr. William Howden, director and only son of Mr. James Howden, of the well-known firm of engineers, was presented by the employés on Thursday last, in the Dining Hall, Scotland Street, with a solid silver tray and silver card case.

Mr. Justus Eck, engineer-in-chief and general manager of the Union Electric Co., left by the R.M.S. *Majestic* on October 1st for a protracted tour in the United States.

The officers of the Blackburn District Postal Telephone Department have presented Mr. Charles Remington, late district manager, with a smoker's cabinet, as a mark of esteem on his removal from Blackburn to the Liverpool district.

Mr. W. Brown, the contract manager in connection with the Blackburn telephone system, has been nominated to a similar position in the Notts. district, with headquarters at Nottingham.

Mr. J. Willey, who is leaving the staff of the Isle of Thanet Traction and Lighting Co., has been presented by the staff with an oak writing desk and oak umbrella stand.

Mr. Walter Ernest Hatfield, electrical engineer at the Smethwick works of Messrs. Harper, Sons & Bean, who has been married to Miss Beatrice Jukes, daughter of Mr. Jukes, engineer and surveyor to the Tipton U.D.C., has been presented by the firm's employés with a silver egg stand.

Mr. A. Bruce Anderson has changed his address from Higher Broughton to 24, Roxborough Park, Harrow-on-the-Hill, Middlesex.

The *Commonwealth Engineer* states that Mr. A. S. Herbert has been appointed general manager in Australia of Siemens Bros. Dynamo Works, Ltd. Mr. Herbert has just relinquished a similar position in charge of the Canadian business of the company.

The same contemporary states that Mr. Ashton Bremner, who went out from England as an engineer in connection with the Hydro-Electric P. and M. Co., Tasmania, has resigned.

An Australian exchange states that Mr. Percy Rosling, Australasian manager for W. T. Henley's Telegraph Works Co., Ltd., at Melbourne, who has come to London, will be succeeded by Mr. H. Norman, who has had charge of the Sydney branch.

Mr. A. S. E. Ackermann, who has been making a series of 35 trials of the Shuman-Boys sun heat absorber in Egypt, has now returned to Westminster after an absence of nearly three months.

Mr. Chas. A. Luke has severed his connection with the *Engineering Review*, both as a director and manager. In future he will devote himself entirely to trade and other exhibition work, and is connected at the present time with schemes in London, Paris, Glasgow, Manchester, Sheffield, &c. Mr. Luke is joint managing director of Walter Cawood, Ltd., whose business is that of organisers of exhibitions of all classes in any country. His address is "Roslyn," Hawthorn Lane, Wilmslow, Cheshire.

Mr. H. J. Osborn, formerly manager of the A.E.G. Electric Co.'s supply department in Manchester, has now severed that connection and gone into business as factor at 7, Blackfriars Street, Manchester, under the title of Crowther & Osborn, Ltd.

The address of Prof. John Perry is now 14A, Campden Hill Court, London, W.

Mr. Herbert E. Tilley, A.M.I.E.E., of Marconi's Wireless Telegraph Co., Ltd, Chelmsford, was married on Thursday last week at the Wesleyan chapel there to Miss Winifred Norris, daughter of Mr. and Mrs. J. A. Norris, Mount Pleasant, Chelmsford. Mr. Tilley was for a number of years connected with Messrs. Bruce Peebles & Co., Ltd., of Edinburgh. Among the many presents received were a clock from "Old Friends" at Bruce Peebles, table silver from the employés of Messrs. Christy & Norris, Chelmsford, and also presents from the staff of the Marconi Co. A unique notification of the wedding was the hoisting of a Union Jack to the top of one of the high Marconi poles (500 ft. high) immediately after the ceremony.

Obituary.—Dr. Rudolf Diesel.—We deeply regret to record that Dr. Diesel, inventor of the Diesel oil engine, disappeared from the vessel on which he was journeying from Antwerp to Harwich on Monday last. He was coming to London in order to be present at the meeting of the Consolidated Diesel Engine Manufacturers, Ltd., on Wednesday. We shall refer to the matter further next week.

Mr. T. Frame Thomson.—It is also with great regret that we have to report the death of Mr. T. Frame Thomson, director or chairman of a number of important electrical undertakings in South America, among them being the United Electric Tramways of Monte Video, Ltd., the Cordoba Light, Power and Traction Co., Ltd., and the Anglo-Argentine Tramways Co., Ltd. Deceased gentleman, who was 46 years of age, and was about to again visit South America, was, it is reported, discovered dead at his residence at Highgate, after accidental shooting.

NEW COMPANIES REGISTERED.

Sandbanks Railless Electric Car Co., Ltd. (131,089).—This company was registered on September 16th, with a capital of £1,000 in £1 shares, to construct, equip, maintain and work and use for the carriage of passengers or goods all kinds of mechanically propelled vehicles adapted for use upon roads, whether moved by electric or other power transmitted thereto by some external source, &c. The subscribers are:—T. B. Scott, 7, Poole Road, Bournemouth, physician, 100 shares; J. J. Allen, Cerne Abbas, Bournemouth, managing director, J. J. Allen, Ltd., 25 shares; C. Carter, Belle Vue, Poole, colliery director, 25 shares; F. Hudson, Penarol, Parkstone, engineer, 25 shares; F. Maddeford, Branksome Park, Bournemouth, contractor, 25 shares; S. J. Mate, 71, Seamoor Road, Bournemouth, printer, 25 shares; H. Newman, Tirgrith, Bournemouth, wine merchant, 25 shares; T. Stevens, Richmond Chambers, Bournemouth, architect, 25 shares. Minimum cash subscription, £750. The number of directors is not to be less than five or more than eight; the first are T. B. Scott, J. J. Allen, C. Carter, F. Hudson, F. Maddeford, S. J. Mate, H. Newman and T. Stevens; qualification, £25. Solicitors: Dickinson, Gwatkin & Manser, Lloyd's Bank Chambers, Poole, Dorset. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Radium Electric Emanation Co., Ltd. (131,069).—This company was registered on September 15th, with a capital of £100 in £1 shares, to take over the business of the London Electric Treatment Co. (1911), Ltd., including the electric light cure and electro-therapeutic institute carried on at 43-4, New Bond Street, W., and to adopt an agreement with E. T. Cocks, receiver for the debenture-holders of the said company. The subscribers (with one share each) are:—J. R. Rowland, 678, Lea Bridge Road, Leyton, accountant; R. W. Maynard, 35, Queen Ann Road, South Hackney, N.E., clerk. Private company. E. W. Barton-Wright is the first sole managing director. Registered office, 43-4, New Bond Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Marconi International Marine Communication Co., Ltd. (65,759).—Return dated July 7th, 1913. Capital, £350,000 in £1 shares, 204,056 shares taken up; £1 per share called up on 99,056; £99,056 paid; £105,000 considered as paid on 105,000 shares. Mortgages and charges, £125,000. Return of allotments made up to July 25th, 1913, shows a further 102,028 shares allotted for cash, £1 5s. being paid on each (5s. premium).

Electrical Power Storage Co., Ltd. (30,313).—Return dated August 5th, 1913. Capital, £100,500 in 20,000 ordinary and 100 founders' shares of £5 each; 66 founders' and 18,592 ordinary shares taken up; £5 per share called up on 66 founders' and £4 per share on 3,132 ordinary; £13,332 5s. 1d. paid, including £474 5s. 1d. on 405 founders' and four ordinary shares forfeited; £77,300 considered as paid on 15,460 ordinary shares. Mortgages and charges: £30,000.

General Accessories Co., Ltd. (104,464).—Return dated August 1st, 1913. Capital, £3,000 in £1 shares (1,580 6 per cent. pref., 920 5 per cent. pref., and 500 ord.). All shares taken up. £1,580 paid. £1,420 considered as paid. Mortgages and charges: Nil.

Paignton Electric Light and Power Co., Ltd. (98,437).—Return dated July 21st, 1913. Capital, £15,000 in £1 shares. 11,610 shares taken up. £11,610 paid. Mortgages and charges: £10,000 (£7,500 mortgage deb., and £2,500 temporary loan). Return of allotments made up to July 28th 1913, shows a further 100 ord. shares allotted for cash.

Electric Construction Co., Ltd. (39,292).—Capital, £400,000 in £2 shares (50,000 pref.). Return dated July 29th, 1913 (filed August 1st). 112,100 ord. and 31,390 pref. shares taken up. £2 per share called up on 2,100 ord. and 18,245 pref. £40,690 paid. £246,290 considered as paid on 110,00 ord. and 13,145 pref. shares. Mortgages and charges: £170,000.

Chile Telephone Co., Ltd.—Capital, £360,000 in £5 shares. Return dated July 31st, filed August 15th, 1913. 66,000 shares taken up. £5 per share called up on 44,000 shares. £220,000 paid. £110,000 considered as paid on 22,000 shares. Mortgages and charges; Nil.

Electric Ignition Co., Ltd. (In liquidation).—A memorandum of satisfaction in full on May 24th, 1913, of debentures dated (*a*) April 10th, 1905, securing £2,000; (*b*) October 5th, 1908, securing £2,000; and (*c*) December 30th, 1908, securing £1,000, has been filed.

W. S. Laycock, Ltd.—A memorandum of satisfaction in full on September 9th, 1913, of charge by deposit of deeds, dated January 10th, 1913, securing balance of account current has been filed.

CITY NOTES.

British Westinghouse Electric and Manufacturing Co., Ltd.

An extraordinary general meeting of the shareholders was held on Friday last at Hamilton House, Victoria Embankment, E.C., Mr. J. Annan Bryce, M.P., in the chair.

The Chairman, in moving the adoption of the special resolutions for the reconstruction of the capital of the company (which appeared in the Electrical Review of September 26th), said they were all aware from the remarks he had made at the last two or three annual meetings, and also from statements recently made in the Press, that it had been the intention of the directors to put before them a scheme for the reconstruction of the capital. The scheme had been delayed, as they would remember, owing to the fact that the litigation between the company and the Underground Electric Railways Co. of London had not come to an end. Their total claim outstanding against the Underground Electric Railways Co., as per the balance-sheet of December 31st, 1911, was approximately £120,000, and certain other items for legal expenses had since been added to this amount, so that approximately £122,000 was the sum they had been fighting for. They knew their appeal to the House of Lords was successful, in that the award of the arbitrator was sent back to him with instructions to take into consideration certain matters which the directors contended should, in fairness, be dealt with. As the first result of the decision of the House of Lords, they got back from the Railways Co. the amount they had paid under the award, so that the amount outstanding was reduced to the sum of £95,680, as in the balance-sheet of December 31st, 1912. After the judgment of the House of Lords which, unfortunately, was not given until the beginning of the long vacation in 1912, every effort was made to obtain a final hearing before the arbitrator, but delays occurred, owing to difficulties in meeting the convenience of the arbitrator as well as of counsel. When at last a meeting was fixed, the arbitrator, the Right Hon. Alfred Lyttelton, fell ill and died, and it became a question of appointing a fresh arbitrator. This would have meant great further delay, and the emergence of fresh complications. It, therefore, seemed best under the circumstances to accept the invitation of the railways company to a meeting with a view to a settlement. This meeting took place, and finally it was agreed that the company should pay them, in addition to what they had already recovered, a sum of £42,500 with an understanding that their former friendly relations should be resumed as though nothing had occurred between them. The result was a loss of £52,000 out of the amount of £95,680 held in suspense in the balance-sheet of December 31st, 1912. Having now ascertained that loss, they were enabled to place before the shareholders the scheme which had been outlined in the circular sent them. The net total by which it was proposed that the capital of the company should be reduced was £725,000. Of this, £225,000 would be applied to writing the ordinary shares down from £5 per share to £2 per share—that was £150,000, the value of patents and goodwill being reduced to the same amount. The balance of £500,000 would be written off the preference shares, reducing them from £3 per share to £2 per share, so that each class of share would now be of the same nominal value. The nominal value of the preference shares would thus stand at £1,000,000. This £500,000 would be applied in the following manner:—(1) Writing down works machinery, plant, &c., from £1,650,346 to £1,232,507, £417,839; (2) writing off loss on Underground Electric Railways contract, £52,049; (3) writing off balance of expenses of issue of prior lien bonds, £11,657; and (4) depreciation of investments, £85,354. Those amounts came to £566,899, against which there was a balance of £66,899 to the credit of profit and loss account on December 31st, 1912. The amount of £417,839 in respect of the works and equipment was mainly accounted for by the fact that on the previous occasion when the capital was reduced the then board did not deem it

necessary, having regard to the large sums at that time to be provided for, to act upon the report of the expert values of the property in its entirety. Had the experts' figures been adopted, it would have meant a further reduction then of approximately £295,000. The board was of opinion that, in the interests of the company, this sum should now be included in the depreciation to be made. Six years had elapsed since the valuation was made, and, of course, further depreciation had been going on all the time. In order to make the position safe, taking a reasonable percentage per annum for these six years, less the sum already provided in those years, the directors were of opinion that, in addition to the £295,000, a further sum of £122,484 should be provided for depreciation of works and plant, making the total amount for this purpose £417,000. With regard to the proposed depreciation of investments, they were aware that their principal investments were in ordinary shares of the Clyde Valley Electric Power Co. £200,000, and the Traction and Power Securities Co., £57,000. At the time of the last reduction of capital those securities were carried forward at their par value, as it was anticipated that they would before long enter upon the dividend-paying stage. While the prospects of both these concerns had continued to improve, there would appear to be no probability of dividends being paid in the immediate future. Neither security was quoted on the market, but, as the result of careful inquiries, the directors recommended a total depreciation of £85,354. They would have seen from the circular that the scheme provided for the maintenance of the relative position of the two classes of shares as it stood at the incorporation of the company, and he did not think he need add anything in respect of this except to emphasise the fact that the new £2 preference shares would be entitled to receive in each year (non-cumulative, of course), the whole of the divisible profits up to 6s. per share, before the ordinary shares could participate. This, of course, was equivalent to 6 per cent. on the original nominal amount of £5, at which they stood when the company was first introduced. He hoped the shareholders would approve of the adoption of this scheme, which had the approval of the American Westinghouse Co., which was the largest holder of preference as well as of ordinary shares. A delay in making the depreciations meant corresponding delay in the payment of dividends, because, as they knew, no dividend could be paid till the loss by depreciation was replaced. If the reduction of capital were made, if trade continued good, and there were no labour troubles, there appeared to be a fair prospect of a dividend in the near future.

Col. Craddock seconded the motion.

Mr. E. Birks said that while he quite agreed that it was desirable to reconstruct the capital of the company if it was to be put on a sound financial basis, he could not agree with the scheme which the directors had put forward. The creation of preference shares entitled to 15 per cent. dividends stood condemned at the very outset. He also objected to the scheme because, if it was carried, it would mean that while the preference shareholders would have been called upon to surrender £1,500,000 of their capital, the ordinary holders would only have been called upon to the extent of £600,000. When they remembered that in a large degree their troubles were due to the administration of the people who held the ordinary shares and who were at the helm in the early days of the company's career, he did not think the preference shareholders should have any sentimental feeling in calling upon them to surrender a great deal more than they thought of doing. Mr. Birks then detailed an alternative scheme which he said he had submitted to the directors in private some time ago.

Mr. Orrell said that as an ordinary shareholder who had paid £7 each for his shares, he had nothing to gain at all, because he did not hold any preference. His idea was that the shareholders did not want immediate dividends—what was required more than anything else to make the machinery hum at Manchester was more cash, and the only way they could get that was to write off a portion of the depreciation out of profits.

The Chairman, in reply, said that the general feeling of the shareholders was that the ordinary shares ought to be written off altogether, for it was the preference shareholders who furnished the cash for the company, many at a premium. The position, however, was that the American Co., who held the great majority of the ordinary shares, approved of the scheme which had been put forward, and would consent to no other. He agreed with Mr. Birks that the proposal of a 15 per cent. preference share was not a nice one, but at the same time he did not think it was likely to have the slightest effect on the company's financial standing. The company had excellent credit, and had got plenty of cash at the present moment, and they were not likely to have any question raised as to their credit by their suppliers. They could go into the market and buy goods on the very best terms. The scheme was the only one that they were likely to carry under existing circumstances, and he hoped it would be agreed to.

The resolutions were then carried, with two dissentients.

Subsequently the scheme was approved at separate meetings of the preference and the ordinary shareholders.

Victoria Falls and Transvaal Power Co., Ltd.

The Marquess of Winchester (chairman) presided at Salisbury House, E.C., on Friday, over the annual general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 468), the Chairman said it was of an equally satisfactory character to that of last year, and they might claim that the foundation of the company's business had been laid on the right lines. The share capital, first and second debenture issues, remained as before. Creditors showed an increase, because contractors' retention account was included in the amount of £328,121, whereas last year this item was under a separate heading. This amount appeared on the other side under the heading "Cash and loans." There was a difference of £878 in these amounts; £47,523 represented money due to contractors and £46,675 the amount deposited with the bank at that date against this liability. On the other side of the balance-sheet, leases concessions at cost and purchase of undertakings showed a slight decrease. This was accounted for because the amount of sales of obsolete plant was slightly more and the depreciation of buildings and plant had been increased on account of further construction. The depreciation and amounts written off expenditure on new stations had been taken on the same basis as for the year 1911, and for the year the amount necessary was less than for the previous year by a sum of £3,000. There were two reasons to account for this: in the first place, the whole of the additional expenditure for 1912 did not rank for depreciation, and, secondly, that in 1911 certain items had been written off, so that this charge did not accrue again in 1912. Expenditure on plant and machinery unerected £48,597 was a new heading. The previous balance-sheet showed an item stores less depreciation. This had now been subdivided into material and plant unerected and general stores and spare parts. Turning to the profit and loss account, the year's operations had resulted satisfactorily. Last year the profit was £323,094, now it was £446,380, an increase of £123,286. The appropriation account showed how this had been dealt with, first in meeting debenture interest; secondly, depreciation and reserve for doubtful debts increased by a sum of £40,790 over the sum devoted last year to this purpose. Thirdly, they carried to the balance-sheet a sum of £169,623, as against £137,093 in the previous year. To this was added the amount brought forward £45,744, giving them £215,367 out of which to consider shareholders' claims. The chairman referred to the delay in calling the shareholders together, but said they trusted they would not be anxious because they knew enough of their financial position to declare and to pay a dividend at the rate of 6 per cent. for 12 months, making the preference shares only 12 months in arrear. He might be asked why, with such a large carry-forward, they did not do more seeing that they had paid a dividend at the same rate over a period of 14½ months in the previous year? Well, they were cautious; they knew that there was evidence of labour unrest in South Africa, and the war clouds in the Near East were still above the horizon. Peace had now ensued, and they might hope that, through the generous consideration of the employers, coupled with the good sense of the majority of the men, the recent scenes enacted in Johannesburg would soon be obliterated by all classes realising that the first duty of a Government was the protection of the individual by the maintenance of law and order and by the individual that citizenship had its obligations as well as its rights. They had paid the dividend which absorbed £118,580, and left £96,788 to carry forward. Briefly to sum up the position, the company's operations for the year under review had resulted in their earning a total net income of £459,579, which had enabled them to provide for depreciations, pay a dividend at the minimum fixed rate on the preferred capital, and to carry forward a substantial sum. Previously, he had always, whilst being confident of the success of the company's business, carefully abstained from any prophecies as to the future. They had now in their statistical department such data as enabled them with as great a degree of certainty as was possible where the human element had to enter into calculations, to foreshadow the future returns from their investment in the company's business. In their first prospectus they foreshadowed that the 6 per cent. preference shares should be participating up to 10 per cent. Their calculations had been based on actual figures of working their business. Assuming again that their profit per unit remained the same and that the notified demands of the mines for power came on at the dates expected, then in 1916 they should be in a position to distribute a dividend on the preference shares at the rate of 10 per cent., and on the ordinary stock at 4 per cent., the back dividend on the preference shares having been met during the intervening years. He thought that might be considered as a justification of the first prospectus, but this result would have been attained without the utilisation of the great power of the Falls, which they still had in reserve as a great hydro-electric problem when the development of Rhodesia was sufficiently forward to demand attention. There were other interesting factors. In January, 1915, the installed plant in the stations of both companies would amount to 265,000 H.P. Another interesting feature of the company's business was the question of coal consumption. He remembered that the advent of the company's operations was viewed by the Transvaal Coal Owners' Association and the Government of the Transvaal, who then controlled the railways, with considerable apprehension. The system which they had adopted in their boiler plants of automatic stokers enabled them advantageously to employ the smaller and least valuable class of coal. The coal owners feared that the general consumption would fall off. At that time the mining companies were their chief consumers of what was known as round coal. The small coal was more or less lost to the collieries; in fact, it cost them money to dispose of it on their dump heaps. By selling them that coal they had been enabled to dispose of their round coal under more satisfactory conditions. They started Brakpan, their first station, in September, 1908. The coal output for the 12 months ending September 30th, 1908, was 2,942,000 tons; the output for the 12 months ending September 30th, 1912, was 4,592,000 tons, or an increase of 1,650,000 tons. The figures for the output for the Transvaal alone for the month of September, 1908, were 250,000 tons; for the month of September, 1912, 392,000 tons; increase, 142,000 tons. Again, the increase of coal traffic over the

railway system, exclusively in the Transvaal, for the year 1911, showed an increase over that of 1910 of 388,095 tons. He thought, therefore, that they could claim to have done no harm to the coal-mining industry of the Transvaal. They were indebted to the Government of the Union of South African States for their response to the appeal of the South African management for adequate protection of their power stations during the labour crisis of last July. They had no differences with their employés, but many of their men were forced to join the strikers. The head office and others of the engineering staff took the places of those who went out, and through their loyalty and zeal, the company was able to maintain supply, the property of the company suffering no damage at the hands of the strikers. During the past year the managing director, Mr. A. E. Hadley, had visited Johannesburg, and previously he accompanied the engineer-in-chief, Mr. Bernard Price, on a visit of inspection of all the large and important power stations in America. All points connected with the generation, transmission and sale of electrical energy were carefully considered by them, but Mr. Hadley told him that he was satisfied that they had a system of supply on the Witwatersrand which embodied all the latest discoveries of the scientific distribution of electrical current. Further, he believed nowhere in the world on anything approaching the same scale had the distribution of compressed air throughout the considerable area over which they supplied power in that form been attempted.

Mr. A. E. Hadley, managing director, in seconding the report, said the chairman had dealt fully with the figures and prospects of their undertaking, but as he had recently returned from Johannesburg, it might be of interest to add a few particulars of a more general character. The total power supplied along the 50 miles of the reef at the present time amounted to 140,000 H.P., and the further business in sight necessary to meet the requirements of consumers represented an increase on this of 40 per cent. With the amount of energy already being sold, the enterprise ranked as the largest supply company in the British Empire, and it was exceeded—and that but slightly—by not more than two or three in the world. To give some idea of the scale of operations, he would mention that at the present time the boilers were burning on an average 1½ tons of coal per minute. After carefully reviewing the knowledge acquired in the last five years under the conditions which existed on the reef, and after examining the practice and installations employed in the largest American plants, he was able to say that the system of their company embodied the best modern experience in the methods of supplying power on a large scale; and were they about to lay out the system again, having the benefit of the experience gained since the stations and lay-out were designed, they would not make any material modifications. In view of the rate of obsolescence in earlier electrical enterprises, this was a matter of great importance. Experience gained, both in South Africa and America, had brought about improvements in details, and these had already been added to the plant on service, being introduced as opportunity permitted, thereby improving the reliability of the supply. The difficulties arising through lightning, which was very severe on the Rand, had been studied with the greatest attention, and had been perceptibly reduced during each of the last two seasons, and the reliability of the supply compared most favourably with any similar undertaking that he had seen in other districts where heavy lightning storms were met with. He was pleased to say that the organisation of the staff was most complete, and comprised in each branch of the business experienced and well-known men, in whom every reliance could be placed. He considered it a great testimonial to the staff that the whole of the plant had been maintained in the highest state of efficiency in spite of the fact that in the past the time available for overhaul had to be reduced to a minimum, due to the difficulty of expanding the company and installing plant quickly enough to deal with the rapid growth of the load. For example, the efficiency of their first stations, which had been supplying for four or five years with the machines on service working practically at full load throughout, showed no diminution, and was as high now as when the plant was installed, while the reliability had steadily improved. This pointed to a long life of the plant. The generating plant was working with a lower coal consumption than he had seen in any other installation, and the tendency was still to improve this.

The report was adopted without discussion.

Sunderland and District Tramways, Ltd.

In a circular issued to the shareholders a scheme for capital reduction, foreshadowed at the last annual meeting, has been prepared. It is proposed to write down the preference shares to 10s. each, to make them non-cumulative, and to extinguish the arrears of dividend thereon, also to write down the ordinary shares to 1s. each. The share capital will then stand at £51,497 (95,495 6 per cent. non-cumulative preference shares of 10s. each, £47,747 10s., 74,990 ordinary shares of 1s. each, £3,749 10s.), in place of £170,485, as at present. Extraordinary general meetings were held on Tuesday to consider the matter, of which we shall publish a report next week.

Eastern Telegraph Co., Ltd.—The second quarterly interim dividend of 1½ per cent. on the ordinary stock, in respect of the year ending December 31st, is announced.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Dividend of 1½ per cent., payable November 1st.

Marconi's Wireless Telegraph Co., Ltd.

This company is holding an extraordinary general meeting at the Hotel Metropole to-day (Friday), when a resolution will be proposed increasing the capital by the creation of 500,000 new ordinary shares of £1 each, to rank for dividends declared in respect of the period commencing January 1st, 1914, but in all other respects to rank *pari passu* with the existing 750,000 ordinary shares of £1 each. In a circular issued to the shareholders, the directors announce their intention to at once proceed to erect the stations in accordance with that contract with the Postmaster-General, which provides for payment when completed. The circular continues:—

"The company has secured, and is also in negotiation for a number of valuable concessions from foreign countries for the erection of stations and the conduct of telegraphic services between this country and the principal commercial centres abroad, which, when organised, should place the company in a position of controlling perhaps the most extensive telegraph business in the world. With this programme there is every reason to expect that the company will secure a substantial and increasing revenue of a permanent nature without reference to the profit dependent upon the position which the company may hold by virtue of its patents. Additional strength is given to the company's position abroad by an arrangement which has been made for the acquisition by this company of the majority of the shares of the Compagnie Universelle de Télegraphie et Telephonie sans fil, of France, which company not only commands a valuable influence in certain foreign countries, but also owns the world-wide rights, other than those of Germany, of Prof. Goldschmidt's inventions, including his high-frequency alternator."

In order to be in a position to efficiently fulfil the above programme this increase of capital is proposed.

"This increase in the capital will secure the company in the strong financial position which is required, having regard to the rapid development of the wireless industry and to the company's operations. If the resolution be duly passed and confirmed, your directors propose immediately to offer to the shareholders 250,000 shares at the price of £3 5s. per share."

The subscription of the whole of the issue of 250,000 shares at £3 5s. per share has been guaranteed by Messrs. Helbert, Wagg and Russell and the Banque d'Outremer.

Marconi Wireless Telegraph Co., of the River Plate.—The annual general meeting of this company was held on August 29th. The report for year ended May 31st was approved. It states that the plans and specifications of the high-power station to be erected at Punta Piedras have been completed and that the installation of the machinery will commence in October. The station will be the most powerful in the world, and it is anticipated that direct communication with Europe will be carried on day and night, it having been decided, on the advice of Mr. Marconi, to increase the power of the station from 300 to 1,000 KW., in order to eliminate the perturbations hitherto experienced in passing through the tropical regions. The profit and loss account shows a debit balance amounting to $105,740.68 gold.—*Review of the River Plate.*

Dundee, Broughty Ferry and District Tramways Co.—In moving the adoption of the report, which recommended a dividend of 2½ per cent. on the ordinary shares, ex-Provost Brownlee said they would have to face the difficulty in the coming year of the taking over of a portion of their line by Dundee Town Council, which had the right, on August 15th next, of taking over that portion of the line from the old Dundee boundary to the new eastern boundary at Craigie. Everything was going on satisfactorily, and it looked as if that state of affairs would continue, whether the portion of the line was taken over or not. Mr. George Balfour, in seconding, said that whenever Dundee Town Council approached them they could rest assured that the company would display a spirit of sweet reasonableness at least equal to that displayed by the various municipalities engaged in the recent annexation controversy. The report was adopted.

South Metropolitan Electric Light and Power Co., Ltd.—Warrants for interest on the 4½ per cent. first mortgage debenture stock, payable October 1st, for the six months ended that date, have been posted.

Anglo-Portuguese Telephone Co., Ltd. — The directors have declared an interim dividend of 4 per cent., free of income-tax, on account of the year ending December 31st next.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. on the ordinary shares, payable October 15th, and one of 3½ per cent. on the preference for the six months ending October.

Prospectus.—*Bell Telephone Co., of Canada.*—Messrs. Higginson & Co. have been offering for sale $4,500,000 5 per cent. bonds, 1925, at 98½ per cent.

Japan.—The amount of capital invested in new electrical undertakings, and in the extension of existing concerns in Japan during the eight months ending with August last, amounted to £4,434,700.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 8 per cent. per annum for the six months ended June 30th last payable on October 15th.

Dick, Kerr & Co., Ltd.

The directors report that the profits earned during the 12 months' trading to June 30th, 1913, amount to £30,092, which, added to the sum brought forward (£10,016), make a total of £40,108. Out of this sum the debenture interest and trustees' fees have been paid, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £11,483, leaving a balance of £28,625 available for appropriation as under: To pay a dividend of 6 per cent. per annum on the preference share capital, £18,300 (the dividend for the half-year to December 31st, 1912, has already been paid, and the dividend for the half-year to June 30th, 1913, will be paid on October 1st); to carry forward £10,325. Whilst the profits for the year are sufficient to cover the payment of the debenture interest and the preference dividend, leaving the profit to be carried forward slightly larger than the amount brought forward from last year, the directors regret that they are unable to recommend the payment of a dividend on the ordinary shares. The special reserve of £16,000, which has appeared on previous balance-sheets, being not now required in connection with the matter in respect of which it was originally instituted, the board have transferred the same to a "reserve for depreciation of investments," and have thereby reduced the book value of the investments. The lamp department having been organised on commercial lines, a trading account in respect thereof has been opened as on July 1st last.

The meeting will be held on October 9th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended June 30th last of 2s. 6d. per share.

Babcock & Wilcox, Ltd.—An interim dividend of 7 per cent. on the ordinary shares is announced for the half-year ended June.

Continental.—France.—La Société l'Accumulateur Tudor, of Paris, reports a profit of £27,037 for the last financial year.

La Compagnie Electro-Métallurgique Franco-Espagnole is the name of a new company which has lately been formed in Bordeaux (11, Place du Quendrices) with a capital of £20,000.

Bank Rate Changed.—The Bank Rate was yesterday raised from 4½ per cent. to 5 per cent.

STOCKS AND SHARES.

Tuesday Evening.

As though to confuse the Stock Exchange as much as possible, the business in the Balkans seems to be starting over again through the unexpected action of Albania. The possibility of the whole affair being reopened tended to cast a fresh damper upon the Stock Exchange, where spirits fell, and prices with them. The threatening aspect of labour in certain directions is also an unfavourable factor; and as soon as one strike is settled, another springs up to take its place with a regularity that tends to become monotonous.

People in the Stock Exchange are beginning to ask whether events are not drifting towards an intolerable state of affairs in the labour world, and a possible conflict of something more than opinion between employers and employed. The formation of a defence union on behalf of the former class is one of those signs of the times which may prove to be of grave significance; at any rate, the investor views domestic securities more and more from the standpoint of a possibility of labour war upsetting profits and prices, and he demands a return on his money commensurate with the risks run.

Home Railway stocks, on the whole, are dull. The market enjoyed a brief spurt of strength in the middle of last week, but within the last day or two the foreign political situation, which cast a cloud over Consols, weighed heavily also upon the Home Railway section. Metropolitans and Districts gave way with the rest, and Underground Electric shares, after touching 4$\frac{1}{16}$, reacted a trifle; the 1s. shares have been keeping about 10s. East London Ordinary drooped to 7½, and the company's junior Debenture stocks are lower.

Electric Lighting shares remain decidedly firm. It must be admitted that business is on a small scale, and the revived talk about the possibility of the City of London Corporation taking over the City of London Electric Lighting Company has had no particular effect since our last notes were written. County of London Ordinary, on the other hand, hardened to 12, and suggestions are being thrown out that the Corporation might not stop at the City company. The other members of the London group are very firm. Notting Hills have risen to 10⅜, St. James' hardened to 9¼, and Charing Cross Ordinary advanced to 4¾. South Londons are easier; Westminsters went back to 9.

Last Friday's meeting of the British Westinghouse Company was responsible for the bringing forward of an alternative scheme of reorganising the company to that which was proposed by the directors. That this would probably be the case was hinted here last week, but it was known in advance that the modification would be offered in no hostile spirit, and the chairman had no difficulty in showing that the plan put forward by the board was really the only one likely to be accepted by the larger interests. The price of the shares has hardened a little to 20s. 7½d.; the 4 per cent. Mortgage Debenture stock at 67½ is steady, and there seems to be little doubt that the alterations will be carried through in due course.

Marconis went back to 3⅞ upon the proposal to increase the capital by the offer of new shares to proprietors at £3 5s. per share. This was counterbalanced by the announcement that the company had arrived at an agreement with the Goldschmidt interests, which should be an excellent thing for both. The price of Marconis thereupon rose to 4$\frac{1}{16}$, but afterwards dragged a little, and finished the week, so far as we are concerned, at 4. Such a concern must be for years to come a continual spender of money as the development of the business requires it. There will be a small bonus involved by the offer of the new shares at 3¼, and the market ought to be relieved, inasmuch as the chance of a heavy increase in capital had been feared for some time past. Americans and Canadians continue in the close vicinity of 1$\frac{1}{16}$ and 11s. 9d. respectively.

Brazilian Tractions went back to 95½, after being up to 98½. The reaction was associated with statements to the effect that the bond issue lately made in Paris by the Brazil Railways, was not a great success, and that for this reason, sales of other Brazilian securities had been coming from Brussels and other places on the Continent. The public look at Brazilian investments of all kinds with some degree of caution just at present, having regard to the uncertainties surrounding the rubber industry, whose product forms so considerable a part of the revenues of Brazil, its railways, and its other industries. Cables from the country tell of business being upset seriously by the crisis in the rubber trade, so it is not surprising that about all things Brazilian there should be just now more than a flavour of speculation.

The Telegraph market continues to show decided firmness, and the way in which some of the prior-charge stocks have been advancing is particularly noticeable. Several shares, too, which were quoted *ex* dividend last Friday, have recovered the distributions. Anglo-American Telegraphs are better than they were, and Reuters rose ½ to 10½. Mackay Common stock fails to recover from its flatness of last week, and the Preferred has fallen a point. Oriental Telephones are a little better at 1$\frac{13}{16}$. The rises in the pre-ordinary issues range from ½ to 2½ points.

A feature amongst Mexican descriptions is a sharp fall in the price of Mexico tramway shares, the drop being no less than 6½ points. This came about in consequence of rumours as to a possible reduction in the quarterly dividend, which for some time past has been at the rate of 7 per cent. The bonds are unchanged, and the Common shares recovered from the worst, although the next official intimation of the dividend is awaited with keen interest. Rio Tramway bonds are firmer, and Singapore Tramways 5 per cent. Debenture stock rose 3½ to 88 *ex* dividend, this following upon the recent buying of the shares, to which attention was drawn here last week. British Columbia Electric Railway issues are a trifle easier. Calcutta Trams rose to 6½.

In the Manufacturing group, British Insulated and Helsby Cable shares advanced to 8½, *ex* the dividend. A small amount of the company's 4½ per cent. Debenture which happened to come to market was eagerly snapped up at 101¾. India-Rubber shares have again improved, at 13¾, being 10s. higher, while small advances occurred in Castner-Kellners and in Callender's Preference. The Rubber share market, after its bout of flatness, rallied a little, but there is no particular faith placed in the outlook for the moment, and only courageous buyers are taking a hand just now.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Sept. 24	4,625	+ 430	39	38,611	+ 2,929	..	..
Blackpool-Fleetw'd	„ 27	7,099	+1,265	12	24,746	+ 3,916	6	..
Bristol	„ 19	35,738	+1,504	..	204,842	+42,232	30·5	..
*Brit. Elec. Trac. Co.	„ 19	167,475	+8,740	..	..	..	459·8	..
Chatham and Dist.	„ 25	4,063	+ 464	38	35,790	+ 2,114	14·98	..
Cork	„ 25	2,151	+ 149	38	19,269	+ 351	9·89	..
Dublin	„ 26	12,498	—11,217	..	220,388	— 6,100	64·25	..
Hastings	„ 25	5,595	+ 414	..	..	+ 2,973	19·3	..
Lancashire United	„ 24	7,085	+1,162	28	58,924	+ 6,286	42	..
Llandudno-Col. Bay	„ 19	2,768	+ 255	42	15,551	+ 1,368	6·5	..
London United ..	„ 26	26,481	+1,002	..	247,796	+ 2,462	..	..
Tyneside	„ 24	2,106	+ 47	13	6,981	+ 478	11	..
Anglo-Argentine ..	„ 23	316,178	+10,306	39	2,100,620	+175,751	..	..
Auckland	Aug. 29	19,548	+ 941	7	41,610	+ 1,150	25·46	1·34
Bombay (B.E.T.) ..	..	..	..	..	..	..	..	..
Brisbane	„ 31	29,970	+2,290	35	207,178	+48,784	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 29	19,685	+2,083	..	..	+99,371	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A. ..	Aug. 31	3,357	..	35	23,379	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 15	3,812	+ 248	39	30,620	+ 2,265	15·25	1
Montevideo ..	..	..	..	..	..	..	..	..
Cen. London Rly.	„ 27	17,176	—1,762	39	187,299	+ 9,048	6·78	·4
City & S. Lon. Rly.	„ 27	10,548	— 698	39	108,511	—10,135	7·26	..
Dublin-Lucan Rly.	„ 26	539	— 186	12½	2,190	+ 66	7	..
L'pool Overh'd Rly.	„ 28	6,744	+ 406	39	67,078	+ 5,190	6·6	..
London Elec. Ry. Co.	„ 27	49,565	— 15	39	527,440	+ 3,780	21·25	..
Mersey Railway ..	„ 29	9,189	+ 84	39	86,982	+ 5,018	4·5	..
Metropolitan Rly.	..	71,011	+4,664	39	665,427	+17,816	29·25	3·5
Met. District Rly.	„ 27	49,462	+ 581	39	502,859	+18,459	25	..

*Includes railways and tramways.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	6	5†	9⅛ — 10⅛	..	5 17 1
Do. 4½ % Pref.	10	4½	4½	9⅞ — 9⅝	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10⅝	+ ⅛	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	95 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	9†	8¾ — 9	..	5 11 1
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 8⅝	..	4 1 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	94 — 97	..	4 2 6
Charing Cross, West End & City	5	5	5†	4⅞ — 5	+ ⅛	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅝	..	4 17 3
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4	..	5 12 6
Do. Do. 4 % Deb... ..	100	4	4	90 — 92	..	4 7 0
Chelsea, Ord.	5	5	4†	4⅞ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	94 — 97	..	4 12 9
City of London, Ord.	10	9	6†	16½ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	114 —118	..	4 4 9
Do. 4½ % Second Deb. ..	100	4½	4½	99 —101	..	4 9 1
County of London, Ord... ..	10	6	5†	11⅜ — 12⅛	+ ⅛	4 18 0
Do. 6 % Pref.	10	6	6	11⅛ — 12	— ⅛	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	102½ —104½	..	4 6 2
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	4 — 4⅜	..	3 8 7
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅞ xd	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 4⅞ xd	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	9	..	7⅞ — 8¼	..	5 9 1
Kensington & Knightsbridge, Ord	5	8	8†	7½ — 8	..	5 0 0
Do. 4 % Deb.	Stock	4	4	88 — 91	..	4 7 11
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	74 — 78	..	5 15 5
London Electric, Ord.	8	2½	..	1⅛ — 1⅜	..	4 7 9
Do. 6 % Pref.	5	6	6	4⅜ — 5½	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3⅜ — 3⅝	..	5 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	96 — 91	..	4 10 1
Do. 3½ % Mort. Deb.	Stock	3½	3½	79 — 82	..	4 5 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 0
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 10⅜	+ ⅛	5 11 7
Oxford	5	7	6†	5⅞ — 6⅜	..	5 9 10
St. James' and Pall Mall, Ord.	5	10	10†	9 — 9½	+ ¼	5 5 3
Do. 7 % Pref.	5	7	7	6½ — 7	..	5 0 0
Do. 3½ % Deb.	100	3½	3½	82½ — 85½	..	4 1 10
South London, Ord.	4	5½	..	2⅜ — 2⅝	— ⅛	7 0 9
Do. 5 % First Mort. Deb. ..	100	5	5	96 — 99	..	5 1 0
South Metropolitan, 7 % Pref...	1	7	7	1 1/32 — 1 5/32	..	6 1 3
Do. 4½ % First Deb. Stock ..	100	4½	4½	94 — 97 xd	..	4 12 9
Urban, Ord...	£3	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	3	..	2⅜ — 2⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86 xd	..	5 4 8
Westminster, Ord.	5	10	10†	8⅞ — 9½	— ¼	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6†	4⅞ — 5⅛	..	5 17 1
Calcutta, Ord.	5	8½	..	7⅛ — 7⅝	+ ⅛	5 11 6
Do. 5 % Pref.	5	5	5	4⅝ — 5⅜	..	4 17 6
Calgary Power, 1st Mort. Bds.	100	5	5	91 — 93	..	5 7 6
Canadian Gen. El. Com. ..	$100	7	7†	111 —115 xd	..	6 1 9
Do. 7 % Pref.	$100	7	7	117 — 122 xd	+ 1½	5 14 9
Cordoba Lt., Power and T., Ord.	1	5	..	⅜ — 7/16	..	6 8 1
Do. 5 % Deb.	100	5	5	91 — 93 xd	..	5 7 6
Elec. Lt. and P. of Cochabamba, 7 % Bonds	100	6		93 — 95	+1	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	87½ — 90½	..	5 10 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	— 94	..	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/32 — 5/32	..	Nil
Do. 6 % Pref.	1	6	..	5/8 — 11/16	..	10 18 4
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5		103 —106	..	4 14 4
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	77 — 81	—1	6 3 5
Mexican Lt. & Power, Common	$100	4	4	66 — 70	..	5 14 4
Do. 7 % Cum. Pref.	$100	7	7	96 —101	— 1½	6 18 7
Do. 5 % 1st Mort. Gold Bds.	..	5	5	10½ — 92½	— ½	5 8 1
Do. 5 % 2nd Mort. Bonds ..	100	5	5	78 — 80	..	6 5 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	73 — 76	— ½	6 11 7
Montreal, Lt., H. and Power ..	$100	9	10†	217 —227	+2	4 8 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	15 — 25	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	102 —107	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	97½ — 99½	..	4 19 6
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	101 —103	..	4 7 5
Shawinigan Water, Capital ..	$100	5½	6†	140 —144	..	3 16 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	100¾ —102¾	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	90½ — 92½	..	5 8 1
Victoria Falls Power, Pref. ..	1	6	6	1 3/32 — 1 5/32	+ 1/16	6 8 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	..	6⅞ — 7⅜	..	6 2 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 97	+2	5 3 1
American Telep. & Teleg., Cap.	$100	8	8	132 —134 xd	..	5 19 5
Do. Collat. Trust	$1000	4	4	92 — 94	+1	4 5 1
Anglo-American Telegraph ..	Stock	3	3	62 — 65	..	4 12 4
Do. 6 % Pref.	Do.	6	6	105½ —106½	..	5 12 8
Do. Def.	Do.	80/-	..	20⅜ — 23⅝	+ ⅛	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	8	..	7 5/16 — 7 7/16	..	5 5 7
Commercial Cable, Sdg. 4% Deb.	Stock	4	4	81½ — 83½ xd	+2	4 15 10
Cuba Telegraph	10	6	6†	8¼ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	5	4	4	8¼ — 8⅝ xd	..	5 6 8
Do. 10 % Cum. Pref.	5	10	..	6¾ — 7¼ xd	+ ⅛	6 18 0
Direct United States Cable ..	10	4	4†	6⅝ — 7⅛	..	5 12 3
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	128 —131	+ ⅛	5 6 10
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	76⅝ — 77⅝	+ ⅜	4 10 4
Do. 4 % Mort. Deb.	Do.	4	4	97 — 99	+2	4 0 10
Eastern Extension	10	7	7	12½ — 13	..	5 7 8
Do. 4 % Deb.	Stock	4	4	95 — 97	+2	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	+ ⅛	3 18 10
Globe Telegraph and Trust ..	10	6	6†	11 — 11½	..	5 4 4
Do. 8 % Pref.	10	8	6	12 — 12½ xd	..	4 16 0
Great Northern Telegraph ..	10	20	5†	30½ — 32½	..	6 3 1
Indo-European Telegraph ..	25	13	..	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	82 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 70	—1	5 14 4
Marconi's Wireless Telegraph	1	20	..	3 15/16 — 4	..	5 0 0
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅛ — 3⅜	..	5 0 9
Monte Video Telephone, Ord. ..	1	6	6	1 5/32 — 1 7/32	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 15/16	..	5 14 3
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99 3/32 —100 3/32	..	4 9 4
Oriental Telep. and Elec. ..	1	10	..	1 15/32 — 1 17/32	+ 1/32	5 6 8
Do. 6 % Cum. Pref.	1	6	6	1 1/16 — 1 1/8	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 10 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96½ — 98½	..	4 1 3
Reuter's	10	10	10†	97⅛ — 103⅛	+ ⅛	9 18 10
Submarine Cables Trust ..	Cert.	6	6	124 —127	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	95 — 97	..	4 12 9
United River Plate Telephone	5	8	6†	6¼ — 7	..	5 14 4
Do. 5 % Cum. Pref.	5	5	5	5 — 5½	..	4 11 0
West Coast of America	2½	2½	..	1 7/16 — 1 9/16	..	4 8 4
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	10	1½	..	2⅝ — 2¾	..	4 6 11
Do. 6 % Cum. 1st Pref. ..	10	6	6	9½ — 10¼	..	5 18 5
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9¼ — 9⅞	+ ¼	6 3 1
Do. 5 % Debs.	100	5	5	99 —101	..	4 19 0
Western Telegraph, Ltd. ..	10	7†	7	12⅜ — 13⅛	..	5 5 8
Do. 4 % Deb.	Stock	4	4	93½ — 95½	+ 2½	4 3 9
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	94 — 97	+2	4 12 9

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

Continued on next Page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	5/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	8 3/8 — 8 5/8	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75 xd	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	4½ — 6	..	..
Do. Do. 6 % Cum. Pr'f	100	6	6	86 — 89	..	6 14 10
Do. 7 % Non-Cum. Pr'f.	100	3	..	49 — 52	+1	5 15 5
Do. 5 % Perp. Deb.	100	5	5	92 — 95 xd	..	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	76 — 79	..	5 14 0
Central London Railway, Ord.	100	3	3	73 — 75	..	4 0 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. Pref.	100	4	4	77 — 79	..	5 1 3
Do. Gtd. Assented	100	..	4	81 — 83	..	4 16 3
Do. Def.	100	2	..	75 — 77	..	2 12 0
Do. Gtd. Assented	100	..	4	79 — 81	..	4 18 9
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	98 —100	..	5 0 0
Do. Do. 1896	100	5	5	98 —100	..	5 0 0
Do. Do. 1901	100	5	5	97 — 99	..	5 1 0
Do. Do. 1903	100	5	5	97 — 99	..	5 1 9
Do. 4 % Deb.	100	4	..	93 — 95	..	4 4 3
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾ xd	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71 xd	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2 1/16 — 2 5/16	..	4 17 7
Do. 4 % Deb.	100	4	4	73 — 78	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	77 — 81	+2	6 3 5
London and Suburban, Ord.	1	..	..	½ — ¾	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	3/32 — 5/32	..	..
Do. Do. 4½ % 1st. Deb.	100	4½	4½	78 — 78	−1	5 15 5

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Sept. 30th.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railw'ys, 4 % Deb.	100	4	4	91 — 93	..	4 6 0
London United Trams, 4 % Deb.	100	4	4	60 — 64	−1	6 5 0
Metropolitan Railway Consol.	100	1⅝	1½†	46½ — 46⅞	— ⅛	3 4 2
Do. Surplus Lands	100	2⅜	2⅜†	59 — 61	..	4 10 2
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	+1	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	77 — 79	..	4 8 7
Metropolitan District Ord.	100	Nil	..	33¾ — 34¼	— ½	Nil
Do. 6 % Deb.	100	6	6	136 —139	..	4 6 4
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	82 — 84	..	5 7 2
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	82 — 86	..	5 4 8
Do. 5 % Deb.	100	5	5	87 — 90 xd	..	5 11 1
Potteries, Ord.	1	3½	..	5/32 — 7/32	..	..
Do. 5 % Pref.	1	5	5	5/16 — 7/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 6 5
South Metro. Trams, 6 % Pref.	1	6	6†	⅞ — 1	..	8 0 0
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Underground Elec. Railways	10	..	..	3⅞ — 4	— ⅛	Nil
Do. "A"	1/-	..	..	1/16 — 1/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	6	6	109 —111	..	5 8 1
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	6	6	90½ — 91½	— ½	6 11 2
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	5	8	12½†	8⅛ — 8¼	..	..
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams. 1st Pref.	5	5½	5½	4 11/16 — 4 15/16	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 18 11
Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Do. 4½ % Deb.	100	4½	4½	96½ — 98½	+ ½	4 11 5
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11⅛	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	..	4 13 9
Do. 5 % 2nd Deb.	100	5	5	96 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	6	6†	95⅛ — 96⅛	−2	6 4 4
Brisbane Trams Invt., Ord.	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 8 11
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def.	100	8	8†	125 —128	−1	6 5 0
Do. Pref. Ord.	100	6	6	111 —115	−1½	5 4 4
Do. 5 % Pref.	100	5	5	101 —105	−1½	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 8
Do. 4½ % Con. Deb.	100	4½	4½	91 — 94	−2½	4 10 5
Calcutta Trams, Ord.	5	7½	..	6 — 6½	+ ¼	5 15 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	..	1/16 — 1/8	..	6 8 1
City Buenos Aires Trams (1904)	5	5†	5	5 5/16 — 5 7/16	..	4 9 11
Do. 4 % Deb.	100	4	4	92 — 97	..	4 2 6
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	90½ — 94½	..	5 5 10
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % A Deb.	100	6	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	25 — 35	..	..

La Plata Elec. Trms, Ord.	1	..	..	⅜ — ½	−1/32	..
Do. Pref.	1	4½d.	6	1 xd — 1 1/32	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1½	..	4 16 1
Do. 6 % Pref.	1	6	6	1 3/16 — 1 5/16	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr. 6% Cum. Pref.	5	6	6	4⅜ — 5 xd	..	6 0 0
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 89	..	5 12 4
Manila Elec. R. and Ltg., Bonds	$1000	5	5	97 — 99	..	5 1 0
Mexico Trams Com.	$100	7	7	90 — 94	−6½	7 8 11
Do. Gen. Con. 5 % Bonds	..	5	5	91 — 93	..	5 7 6
Do. 6 % Bonds	100	6	6	93½ — 95½	..	6 5 8
Para Elec. Rlys. & Lt., Ord.	5	10	10†	6 — 6¼	..	7 13 10
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	98½ —100½	..	4 19 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	..	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102½ —103½	+ ½	4 16 7
Do. 5 % Mort. Bonds	100	5	5	97 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102½ — 104½	..	4 15 8
Singapore Trams, 5 % Deb.	100	5	5	86 — 90 xd	+ 3½	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 5	..	7 0 0
Do. 6 % Pref.	5	6	6	4 13/16 — 5 1/16	..	5 18 7
Do. 5 % 1st Deb.	100	5	5	97 —100	..	5 0 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7

MANUFACTURING COMPANIES.

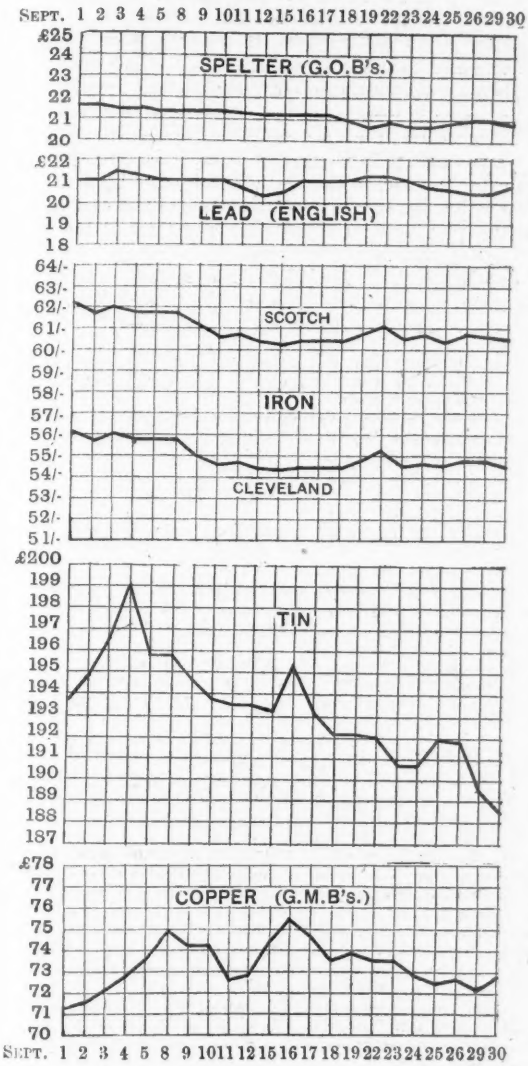
Aron, Ord.	1	7	..	2/16 — 13/16	..	8 12 4
Do. 6 % Pref.	1	6	6	3/4 — 13/16	..	7 18 4
Babcock & Wilcox	1	16	..	3 1/16 — 3 1/16	..	5 0 5
Do. Pref.	1	6	6	1 1/16 — 1 1/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1/32 — 1/32	..	..
Do. 6 % Cum. Pref.	1	6	6	1/16 — 1/16	..	6 8 0
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	..	5 5 8
Do. Deb. Stk.	100	5	5	84 — 86	+ ½	5 16 3
B I. & Helsby Cables	5	10	..	8½ — 8⅝ xd	+ 1/16	5 14 3
Do. Pref.	5	6	6	6 — 6½	+ ¼	4 12 4
Do. Deb.	100	4½	4½	100 —103	+1	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92⅜ — 95⅜	..	4 14 0
British Westinghouse, Pref.	8	Nil	..	1/16 — 1/8	..	Nil
Do. Deb.	100	4	4	66 — 69	..	5 15 11
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 15 5
Browett, Lindley, Ord.	1	..	..	3/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- — 8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	70½ — 75½	..	6 12 5
Do. 4½ % Deb	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	5	15	..	11 — 11⅜	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	−1/16	4 17 7
Do. Deb.	100	4½	4½	96 — 99	..	4 10 6
Casmer-Kellner	1	20	..	3 13/16 — 3 15/16	−1/16	5 1 7
Do. Deb.	100	4½	4½	102 —105	..	4 5 9

Crompton & Co., Deb.	100	5	..	54½ — 59½	..	8 8 0
Dick, Kerr	1	Nil	..	3/16 — 3/16	..	..
Do. Pref.	1	6	6	3/4 — 13/16	..	7 13 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — ⅛	..	Nil
Do. fully paid	5	Nil	..	½ — 1½	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	..	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68 xd	..	7 7 1
Electric Construction	2	5	..	1 — 1½	..	8 0 0
Do. Pref.	2	7	7	1⅝ — 2⅛	..	6 11 9
Greenwood & Batley, Pref	10	7	7	6½ — 7½	..	9 13 2
Do. Deb.	100	5	..	92 — 94	..	5 4 2
General Electric, 6% Pref.	10	6	6	9¼ — 10¼	..	5 14 3
Do. Deb.	100	4	4	87 — 92 xd	..	4 7 11
Henley's, Ord.	5	15	10†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 8 11
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	7½	..	13½ — 14½	+ ½	5 5 3
Do. Pref.	10	5	5	9⅜ — 10⅝	..	4 18 9
Telegraph Construction	12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson	100	4	4	55 — 60	..	6 13 4

* Unless otherwise stated all shares are fully paid. † Interim d

METAL MARKET.

Fluctuations in September.



A Big Gas Engine.—Writing in *Power*, Mr. F. R. Low gives some particulars of the power plant in the Ford Motor-Car Works, in Detroit. The first unit installed was a 35 × 48 in. two-cylinder tandem producer-gas engine, running at 100 R.P.M. It drives an 850-KW. Western Electric generator and a 2,000 cb. ft. air-compressor, to which it is cross-connected, and develops only about one-quarter of the power which the works at present demand. The new large engine was built at Hamilton, Ohio, by the Hooven, Owens, Rentschler Co. The engine casting is designed symmetrically around the centre line. There is no massive bed-plate ; the weight is carried directly by the foundation with light sole-plates and guides at the places where movement will take place. There are four double-acting cylinders, 42 × 72 in., two in tandem upon each side, held together with four 6-in. tie-bolts. The engine is designed to run at 85 R.P.M., or 1,020 ft. piston speed. There have been gas engine cylinders of greater diameter, but this length of stroke gives, it is believed, the greatest displacement that has yet been attained per cylinder. The length of the engine from the front of the pillow-block to the end of the tail-rod extension is 73 ft., and its overall width is 32 ft. The crankshaft is 32 in. in diameter, 25 ft. long, carrying an 80-ton fly-wheel and a 2,500-KW. generator armature, and the connecting rods weigh 10,300 lb. each. The generator is capable of carrying a 25 per cent. overload, and the engine has a capacity of 5,000 I.H.P. The lay-shafts are driven by bronze worms upon the main shaft, and are divided by pin couplings, so that, as expansion takes place, each section remains with its particular cylinder. Each lay-shaft carries four cranks, one for each end of each cylinder, and each crank operates both the inlet and the exhaust valve of the end which it serves. Both of these valves are of the mushroom type, and are located in pockets in the bottom of the cylinder. Governing is by the quantitative method, and the governor, which is of the Jahns type, has no other work to perform than to adjust the position of the tripping cams. The entire gear is direct-acting, simple and accessible. Water for cooling the pistons is taken in at the crosshead between the two cylinders through a telescopic rod.

THE MUNICIPAL TRAMWAYS CONFERENCE.

In our last issue (page 505) we briefly referred to the opening day's proceedings of the Municipal Tramways Convention, which was held at Sheffield last week. The proceedings commenced with an informal reception at the Victoria Station Hotel on the Tuesday evening, and on Wednesday and Thursday Mr. A. R. Fearnley presided over meetings at the Town Hall, where the visitors received an official welcome by the Lord Mayor (Ald. S. Osborn) on Wednesday morning. Fortunately for the visitors, the steel city was in its sunniest mood, and this, coupled with the complete programme which had been arranged, made the three days' stay a very pleasant one.

Many of the visitors were entertained at luncheon by the Sheffield Tramways Committee on both Wednesday and Thursday ; on the evening of the former day, many availed themselves of the Tramways Committee's invitation to the Lyceum Theatre, and subsequently to supper at the Town Hall, at the invitation of the Lord Mayor.

For Thursday afternoon a series of visits had been arranged to local works, including those of Messrs. Edgar Allen & Co., Hadfield's Steel Foundry Co., and S. Osborn & Co., and to the local power stations, tramway depôts, and Sheffield University. In the evening the annual dinner took place at the Victoria Station Hotel, which was the head-quarters of the Association during its visit.

On Friday morning an early start was made with the annual business meeting, at which Ald. H. Lindsley, Salford, was elected president, and Mr. Peter Fisher, Dundee, vice-president of the Association for the ensuing year ; subsequently the day was almost wholly devoted to an excursion to the Dukeries, including a visit to Welbeck.

Presidential Address.

In the course of his Presidential address, Mr. A. R. Fearnley (general manager, Sheffield Corporation Tramways) said that 19 applications were deposited in Parliament by municipalities at the beginning of the year, relating wholly to or containing clauses as to tramways, motor-'buses, or railless traction powers. In actual tramway operation, improvements were constantly being brought about. There was a tendency on all systems to improve "running time," and large sums were being spent in removing small equipments with which cars were fitted 12 or 14 years ago, and replacing them with equipments double the size and of an improved type—the interpole motors having proved a success and now being generally adopted as more capable of coping with the heavier traffic requirements of to-day.

In those towns which were early in the field with electric traction, car bodies were being re-designed and reconstructed, giving easier and safer access, with covered top decks and increased carrying capacity. Speeds were gradually being increased, with the result that calls had been made upon the power-house and permanent-way branches of the department earlier than they would have been under the old condition of things.

As a result of the experience gained, better work was being put into tramway tracks to-day than at any time previously in the history of the undertakings ; the mechanical joint was rapidly becoming obsolete, and welded joints were being almost universally adopted.

The idea of isolating the tramway power house from the other supply stations in the district was being abandoned, and in Sheffield they hoped before the end of the year to have completed arrangements by which any of the three power houses would be available for tramway supply, in case of heavy load, and at other necessary times. In other words, the plant which was being used during 5½ days in the week to supply power to the large works in the east end of the city, would be available for week-end, Bank holiday, and football traffic. In addition, demands for more frequent services had to be met.

The length of the 1d. stage was playing a more important part in the development of municipal areas than many people had any idea of. It was one of the most valuable assets of all large towns to be able to transport their passengers a distance of three miles from the centre for 1d., and very wide benefits would be derived from a policy of this description.

In 1912 the railways of this country only added 24 miles to their tracks, and carried nearly 32 millions fewer passengers than in the previous year ; whereas on the tramways the passengers carried for the 12 months dealt with in the last Board of Trade Return showed an increase of 220 millions on the previous year.

The decision of Parliament on the London County Council (Tramways and Improvements) Bill, 1913, and the reversal of the Parliamentary Committee's decision with regard to compulsory running powers was a notable victory for the County Council, and might be useful to many of them on future occasions. The decision of the Lords of Appeal on the Rating of Tramways was a disappointment, and meant a reversion to the previous heavy charge that was made upon them each year for the rating of their systems. To the Sheffield tramways the decision meant an extra charge of £4,200 per annum. The report of the Select Committee on Motor

Traffic appeared to assist in many ways the demand for equality of treatment for which they, as tramway owners and operators, were now asking. The essentials on which the Committee agreed were definitely stated. Summarised, they meant control by a Government department in consultation with local authorities. It was quite clear that whatever the results of present developments might be, the leading municipalities, at any rate, intended still to control the systems of traction, and it remained for them to see that their sinking funds were in such a healthy condition that they were in a position to take advantage of any change that might be found to be advisable. The 30-year loan periods which were granted when powers were obtained in the early days to construct the tramways might not after all turn out to be the advantage which at that time they considered them, seeing that in many cases all the available balances were used for other than tramway purposes.

During the past session in Parliament a considerable number of municipal authorities had obtained powers to work motor traffic, and his remarks on this subject chiefly referred to the motor-'bus. He recognised that the question of the motor-'bus was the one that, next to their own business, loomed largest in the minds of most tramway operators in the country, whether municipally or company controlled. To some members it was a question of unfair competition with the tramways, and, perhaps, for the moment only, that was the most serious phase of it. There would, he was sure, be unanimity in accepting and supporting the resolution put forward by the Croydon and other Borough Councils in the Metropolitan area in this matter.

To a number of municipalities it was either a question of extension of their tramways or substitution by the motor vehicle or trolley car, and this was undoubtedly the most interesting problem for the provinces. His personal views on this matter were that there were good types of motor and trolley vehicles to be obtained, the carriage portion of which, however, was somewhat crude and ugly, and followed much too closely upon the lines of the old horse 'bus, and provided very limited accommodation when compared with that to which tramway passengers were now accustomed; that there were very few roads in the provinces which were really suitable yet for such a vehicle, and that it was now more a problem of the road than the vehicle.

There was a large mileage of tramway permanent way which required, or would shortly require, renewal. Here, then, was an opportunity for some authority to make an interesting and valuable experiment by taking an existing tramway route, the traffic results of which were well known, and deciding that the tramway service on this route should at least experimentally, if not permanently, be withdrawn and a suitable road surface be laid down and motor 'buses or trolley vehicles substituted for the cars.

The motor or trolley vehicle would cut down the available comfortable accommodation for over six months in the year to one-third the present accommodation, if a similar service and a similar number of vehicles as were already provided by the tramways were substituted. The total working expenses should certainly not be more than total tramway costs, which figure, however, would not include any allowance for road maintenance over and above the petrol tax of 1½d. per gallon, so that if the routes were outside the city or borough boundaries, this figure would need adding on, at any rate, until the question of contribution to road maintenance was finally settled. There was no difficulty in obtaining contracts for the maintenance from first-class firms at 1d. (or less) per 'bus-mile, and instead of motor spirit being more expensive, as was anticipated, the present indications were that before very long there would be a drop in price, so that 'buses might be worked at an even lower figure than they were to-day. So far as electrically-propelled vehicles were concerned, electric power promised to have the same tendency.

They must try and keep an open mind when considering this question. Although, so far as he could see at present, there was little likelihood of the motor-'bus taking the place of the tramcar for heavy traffic, it must be remembered that great improvements were likely to be made in the efficiency of the present vehicles. It would be of great advantage to them all when reliable figures were published in detail under the standard form of tramway accounts, as he anticipated they would be early next year by quite a number of municipal tramway departments.

The Sheffield Tramways Committee ordered 10 'buses, and they had been working regular services since the beginning of February last; the 'buses were at work on four routes, and a fifth route was to be opened next month. The vehicles had proved reliable in service, and had now run over 100,000 miles. In two instances they had been taken out into the country districts, three miles from the tramway routes, and in both these cases the traffic had been very heavy, especially on fine days and during week ends. If reasonable use could be made of the vehicles during the winter months, there was no doubt that next summer they would require a much larger number of 'buses and would have to go still further afield in order to meet the requirements of their passengers.

Of course, before adopting such a change, trackless trolley cars must have the serious consideration which they undoubtedly deserved.

The Advantages and Disadvantages of Platform Fare Collection.

By Ald. Flint, Leicester.

Although this paper is of considerable interest to the budding tramway manager, it scarcely lends itself to reproduction in the Electrical Review.

It may be briefly summed up as a history of fare collection on the Leicester Corporation tramways, profusely illustrated with tramway tickets, passes, &c., and as the historian happens to be the chairman of the undertaking, probably little has been left untold.

From it we gather that Leicester is blessed with an amazing and, to the stranger, confusing variety of tickets—overlapping discount, transfer, return, return-transfer, &c.—as well as with passes for blind and crippled persons.

While we are, of course, unable to appreciate the niceties of these blessings in disguise, it is at least certain, judging from the statistical table contained in the paper, that the Corporation tramway receipts have steadily gone ahead during the past few years, and that the undertaking is in a flourishing condition.

But the part of Ald. Flint's paper which will appeal to our readers deals with the P.A.Y.E. system in use at Leicester. Referring to the cars, he says :—

The platform is divided into two gangways by means of a rail, behind which the conductor stands and collects the fares as the passengers board the car.

Passengers, on paying their fares, receive a ticket, the colour of which denotes the stage to which they are entitled to travel, and on leaving the car the ticket is deposited in a sealed box fixed on the platform, specially designed for this system, which enables the motorman or conductor to detect by the colour of the ticket whether a passenger is over-riding.

Transfer and workmen's tickets are issued on these cars, but passengers are not required to deposit these tickets, but to show them on leaving the car.

Pay-as-you-enter tickets are numbered in the usual way, and booked on the way-bill, but are not punched, as, if a conductor issued an old ticket, he would be detected at once by the number if an inspector boarded the car.

In considering the experimental adoption of the pay-as-you-enter system, consideration was given to the advantage of minimising the risk of accidents caused through passengers attempting to board and alight from cars whilst in motion. During the year ended December 31st, 1912, at Leicester, 449 persons received injuries through attempting to board or alight from cars whilst in motion.

Our experience with pay-as-you-enter cars proves that accidents of this description are practically nil. The conductor, always being on the platform of the car, is enabled to prevent people from risking this foolish practice.

We find that the cars run well to time, and there is no more trouble or time lost in loading these cars than the ordinary ones.

The motormen and conductors working these cars are very much in favour of this system, the conductors because they can do their work more efficiently, and without the excessive strain of constantly going up and down stairs to collect fares, and at the same time keep a proper look-out for intending passengers; the motorman, because he can give the whole of his attention to his own end of the car, and knowing that the conductor is always on the back platform, it is not necessary for him to strain his neck in endeavouring to make quite sure the back platform is clear before starting the car.

The route selected for the experimental trial of this system (Narboro' Road) was previously a through route, and was chosen chiefly because it was a short distance and thickly populated.

The passengers are restricted to the district, and over-lapping passengers, who are very numerous, due to the principal railway station being at the end of the over-lapping stage, have been diverted to another section.

The receipts for 12 weeks ending July 5th on P.A.Y.E. cars amounted to £2,798, passengers, 703,134; in the corresponding period of 1912 the receipts were £2,827, passengers, 681,578, or a decrease of £29 in receipts, the increase in passengers being accounted for by the recent introduction of ½d. children's fares.

The Western Park route, however, which has been altered to the through route, shows receipts for the same period of 1913 of £2,176, against £1,444 for the corresponding period of last year, or an increase of £732, due in a great degree to the overlap and through riding.

Taking this into consideration, there has undoubtedly been a considerable increase in the sectional receipts, quite equal to, and, I think, in excess of, the average over the whole system.

Naturally we have had a certain amount of public criticism in introducing a new system; this was only to be expected.

The chief complaints were :—

Passengers on the upper deck had to leave their seats some distance before reaching their stopping point to notify the driver.

The continual opening of doors on the upper deck made the cars very draughty.

There was no accommodation for luggage.

The staircases were narrow and steep.

The last two were the principal objections.

All these points have now been met. Accommodation has been provided for luggage, and the design of the staircases is being improved.

The first objections were overcome by allowing passengers *en route* to leave the car by either staircase.

At the present time I do not think there is anything to which any reasonable person could raise objection.

The paper also contains a list of instructions to conductors on P.A.Y.E. cars; numerous reprints of conductors' way bills; and a plan and statistics of the Corporation tramways.

Councillor J. A. Smith (Aberdeen) complimented the author on his admirable explanation of the complicated ticket system at Leicester. The Aberdeen Corporation had also adopted the P.A.Y.E. system, and 11 such cars had been employed on a 2½-mile route during the past five months. The Aberdeen cars differed somewhat in construction from those in use at Leicester and the fare system was simpler. Although congestion of entering passengers was feared when the cars were introduced, no difficulty had been experienced, as the great majority of the passengers had their fares ready. Under the old system the journey occupied on the average 35·1 min., and with the P.A.Y.E. cars this had been reduced to 34·2 min. Their experience in regard to immunity from accident agreed with that of Leicester, and the Aberdeen police were decidedly in favour of the new cars. Some small constructional alterations had been suggested, and would be incorporated in new cars when, in the near future, the extension of the system to other routes in Aberdeen came up for consideration. Fare collection was much facilitated; the average receipts on the route were over £23 per week better during the 20 weeks of running, although some of this was due to the natural increase in traffic.

Bailie Alston (Glasgow) asked how the author's colour scheme for distinguishing tickets would work with, for instance, a Glasgow route containing 35 ½d. stages, besides 1d., 1½d. and 2d. stages. He also wished for more accurate figures for the natural increase of traffic on the P.A.Y.E. route at Aberdeen.

Mr. W. A. Luntley (Wolverhampton) thought it possible that the conductor might reap the benefit from the ticket discount system at Leicester; he doubted whether the conductor on a P.A.Y.E. car could have more time to look out for passengers.

Mr. A. L. C. Fell (L.C.C.) discussed the application of the P.A.Y.E. system to the L.C.C. cars; it would be a costly matter to alter the present platforms and staircases of 1,750 cars, and there was the question of royalty to be considered. He thought that time would be lost while loading, and waiting passengers would be snapped up by the competing motor-'buses; it would also be impossible to compel all passengers to have their fares ready. It would, however, be in favour of the system that the driver would be free from other duties than driving.

Councillor Buist (Dundee) pointed out that the speed of the P.A.Y.E. cars at Aberdeen was only about five miles an hour, and another speaker remarked that the drivers of these cars at Leicester had the additional duty of checking the tickets of passengers getting off the front end.

Mr. J. M. McElroy (Manchester) said that he had been impressed on a former visit to America with two factors in their tramway working, viz., danger to passengers boarding cars and difficulties of ensuring fare collection. On his recent visit he found great changes connected with placing the conductor on the rear platform, which ensured fare collection and practically got over the heavy liability for accidents, which had formerly amounted in compensation to 5 per cent. of the receipts. The universal fare in America facilitated a system such as the P.A.Y.E., but difficulties arose in its application to English undertakings with their complicated fare systems. In the latest American P.A.Y.E. cars, the passengers boarded at the front end, and as the driver had to shut the door and fold the step before he could start, accidents were almost impossible to passengers entering.

Ald. Banton (Leicester) assured the meeting that the P.A.Y.E. cars were, if anything, quicker to load, possibly due to the organised stream of entering passengers.

Ald. Flint, in replying, said it was intended to use the cars on the through routes, and that it would lead to a saving of one car in 20 of those at present in use. Any delay at starting was more than saved during the journey.

To alter ordinary cars to the P.A.Y.E. system cost between £30 and £40 per car, and the royalty was £20 per car altered.

The Maintenance of Paving on Tramway Track as Affected by Sec. 28 of the Tramways Act, 1870.

By Councillor W. C. Fenton, Sheffield.

The theme of Councillor Fenton's paper was sufficiently important to warrant his effort to re-open a discussion on the subject.

Sec. 28 was passed in the days of the horse tramway, and, moreover, at a time when the operation of tramways was in the hands of companies on whom it was considered necessary to impose some safeguard in the interest of the public road authority; but, in view of the altered conditions of tramway working, it has outlived its day, and is in urgent need of revision. Indeed, that a law which has no logical application should still be the law of England is somewhat of a reflection on the gentlemen who boast of their enlightened legislation.

A revision of Sec. 28 would, on the face of it, greatly benefit the privately-owned tramway undertaking, while even the municipally-owned concern would be better off, in that its position as a trading undertaking would no longer be obscured by annual subsidies to the road authority.

This subsidy question is of more importance than appears at first sight, because of the increasing burden of road maintenance arising from the present-day heavy motor traffic, which naturally uses a well-laid tramway track wherever and whenever possible.

All these and other points are referred to by Councillor Fenton, who also draws largely on the earlier discussions on the same subject which have occurred at previous tramway conferences. As showing the vehicular traffic on the road he quotes:—

Two local instances:—In Furnival Road (near the Victoria Station) in a recent 24 hours' observation there were 3,327 vehicles proceeding in the same direction as the *down* track, and only 137 tramcars during the same period. Those 3,327 vehicles were spread over every portion of the available road not occupied by the *up* traffic. The *down* track referred to is very little used by tramcars, but the result to the rails—apart from the paving of the road—as shown by an accompanying diagram, is about $\frac{5}{16}$ in. worn off both tread and lip.

In High Street, where the largest number of trams pass to and fro, there were on an average day from 6 a.m. to 9 p.m. 3,494 vehicles (excluding bicycles) as against 2,940 tramcars, or 554 more, but this was in a wide street where the tram tracks are not so much used for ordinary vehicular traffic as in narrower streets. In this case the carriage-way was 50 ft., and in the former case 31 ft. wide only.

Mr. A. L. C. Fell has kindly supplied me with two typical cases in London from 8 a.m. to 8 p.m.

In Queen Street, Hammersmith, there were 336 electric cars and 4,140 other vehicles (excluding bicycles), including 973 motor-'buses.

In Lea Bridge Road there were 547 electric cars and 2,522 other vehicles, including 771 motor-'buses.

Cases such as the above, if they do not provide an unanswerable argument in favour of the repeal or amendment of Sec. 28 of the 1870 Act, do provide good reasons for a searching inquiry into the operation of the clause with a view to revision.

Figures quoted in the *Tramway and Railway World* for July 11th, 1912, show that for the 16 municipal systems the cost amounts to £132,584 per annum for maintenance of permanent way, and £123,787 per annum for rates, sufficiently startling figures to be worthy of the most careful thought and consideration.

The decision of the House of Lords on July 24th last, in the Tottenham Urban District Council's rating appeal in connection with the Metropolitan Electric Tramways, Ltd., has accentuated the sense of injustice which tramway concerns feel in connection with this subject. In Sheffield it has caused an increase of over £4,000 on the rates for the present year. The rating of tramway tracks is practically a rent for the "partial monopoly" of a portion of the street, and if assessed under Sec. 211 (1) (*b*) of the Public Health Act, 1875, in the proportion of one-fourth only of the net annual value, gives a very handsome rent to the local authority. But if, in addition, it not only keeps in repair the larger area of the road, and out of its profits relieves the rates—and in some important cases pays a proportion of the cost of street improvements—the argument for reconsideration becomes much stronger.

Councillor Fenton gives a number of reasons for and against having the objectionable Section of the Act revised, and further replies to the objections. The various points which he discusses have mostly been covered in our pages; he, however, mentions a matter of some interest, namely, that Parliament has recognised the principle of extraordinary traffic in the Brighton and Hove Omnibus Co.'s Act and the Chesterfield Corporation Act, where provision is made for partial payment of road widening and extra cost of road maintenance falling on those who run the vehicles.

In conclusion, assuming that the present application of Sec. 28 of the Tramways Act, 1870, is inequitable, what, says Councillor Fenton, are the suggested remedies?

(*a*) Differential rating on the basis of one-fourth the net annual value, or

(*b*) The reduction of the cost of track maintenance to tramway concerns by one-half, the local highway authority paying the remainder, or

(*c*) By both (*a*) and (*b*).

(*d*) By the repeal of the exemption under the Finance Act, 1910, referred to previously, and the formation of a fund by which local authorities shall be allocated proper proportions of the yield of the tax towards road maintenance on tramway as well as other routes.

(*e*) By the repeal of the 5th Schedule, Part 1, of the Finance Act, 1910, except Paragraph 4, thus allowing the rebate on petrol to medical men only, and the payment of the increased duty to the proposed fund referred to in (*d*) above.

The proposals (*d*) and (*e*) would then provide that those who mainly use the roads, or who chiefly contribute to their destruction, would pay directly towards maintenance and renewals.

Whilst highway authorities are responsible for the general upkeep of the roads (except as exempted by Sec. 28 of the Tramways Act, 1870), it will be only reasonable that if the burden now placed on tramways is wholly or partly transferred to the highway authorities, there should—in view of the enormous change in the character of the traffic—be some relief from imperial sources. This principle is already recognised in the grants from the Road Board, but the amounts so allotted should be considerably increased.

The paper concludes with a number of appendices intended to show as far as possible the cost of either permanent way or track paving maintenance; in some cases the rates paid are given. From these particulars we abstract the following for the year 1912 and 1913 :—

	Maintenance and renewal perm. way.	Rates.	Maintenance cost of track paving.
L.C.C.	£125,486	£98,293	£58,334 £215 p.m., s. track.
Manchester ...	£15,169 £87 p. mile	£44,224	—
Leeds	£25,415 £414 per route mile	£19,809	—
Glasgow ...	£74,071	—	—
Bradford ...	—	—	£12,262 (estimated).
Sheffield ...	—	£10,500	£10,796
Yorkshire W.R. Tramways ...	—	£519	£4,600 av. for 5 yrs. to 1911-12.

Discussion.

Councillor Spencer (Halifax), who opened the discussion, argued that it was a financial question; tramways were rated according to their ability to pay. The tramway was rated for the use of one street only, but the motor-'bus itself was not rated, and could use any street; it seemed only fair that the 'bus concerns should pay according to their earnings. In Halifax, in narrow streets the tramway authority paved and maintained the whole of the road. The Road Board were apparently engaged in investing money; he understood that three millions had been so invested, but the local authorities had got little or nothing.

Mr. Smith-Saville (Darwen) said that 12 years ago track maintenance cost them £380 per mile, but since the advent of the heavy motor traffic this had gone up to over £800 per mile. It was true that the paving round the track was the best on the road, and it had to be in order to save the rails now that such heavy motor traffic used the roads.

Ald. Cunliffe (Rochdale) said the question of track paving repairs had been mutually arranged in his town. He suggested that the Road Board was voting large sums of money for the permanent improvement of the country roads.

Ald. Trumble (Croydon) said the paper resolved itself into the question whether the Tramways or Highways Committee should pay for certain work. It did not really affect the local tax-payer. If they were going to tax wheeled traffic, it seemed only equitable to tax every vehicle, but the question was a difficult one, as had been proved in the case of Croydon, where the London 'buses were running in competition with the tramways.

Bailie Alston (Glasgow) urged that there was a difference between a vehicle which merely transported goods over roads and a vehicle which earned its income on the streets. He thought there should be some method of making such concerns as 'bus companies pay something for their accommodation.

Mr. J. B. Hamilton (Leeds) said the payments for maintaining tracks, &c., must be looked on as a rental. It must be admitted that some wear arose from the presence of the rail, and after all, the tramways had got along very well, despite the payment. The matter had, however, been reconsidered, under present-day conditions, and it was a question whether some action should not be taken, and some resolution agreed on at the conference.

Another speaker that said in his town an arrangement had been come to by which the tramways paid two-fifths and the Highways Committee three-fifths of the cost of road paving repairs, as it was admitted that great wear arose from general dock traffic.

Mr. W. J. Squires (L.C.C.) agreed with a previous speaker that there was a difference between the omnibus earning its income on the streets and the ordinary carrying motor-vehicle.

Mr. H. M. Sayers (Tramway and Light Railways Association) said the question was of the greatest importance to the companies, and it could not be expected that the Corporations should look on the matter in quite the same way as the former. The difficulty in rating a 'bus was that it was not a hereditament in the same way as a tramway or railway was.

Mr. H. England (Wakefield and District Light Railway) voiced the increasing burden of road maintenance due to heavy road traffic in his district. He thought that what was wanted was a general overhaul of tramway legislation; it would, for instance, be better instead of the present Parliamentary procedure, if experienced men considered proposed tramway schemes, and that they were considered more than once a year.

Mr. Hadfield (Surveyor, Sheffield) said his town had had nearly £30,000 out of the Road Board.

Councillor Fenton, in replying, said that although Sheffield was now receiving a grant of £17,000 from the Road Board, none of that would be spent on any road containing tramway tracks.

Alderman Linsley (Salford) proposed a resolution that the meeting was strongly of opinion that the time had arrived when Sec. 28 should be revised.

The Secretary (Mr. C. J. Spencer, Bradford) read a resolution passed at a special meeting in July, which practically covered the main points of the first proposal.

Mr. J. M. McElroy (Manchester) said the proper course was to let the matter stand as agreed at the July meeting, and this course was adopted.

An appendix supplied by Mr. A. de Turckheim shows local rates and repairs of permanent way paid by 34 tramway companies, 1912, as follows :—

Letter.	Miles of single track.	Total.	Per mile of single track.	Cost of rates. Total.	Per mile of single track.
A		£	£ s. d.	£	£ s. d.
(32 companies)	578·95	66,840	115 9 0	35,860	72 0 0
B	100	12,132	121 0 0	16,067	160 10 0
		22,563*	225 0 0*		
C	28·7	1,715	59 15 0	4,617	160 17 5

* Renewals.

Unfortunately the data for the various towns do not appear to be strictly comparable; there is, however, in some instances a marked increase in cost per mile of repairs, &c., year by year during the last five years, but Manchester, where one would expect the costs to increase, due to the heavy motor traffic, shows a decreasing cost during the last two years. (*To be continued.*)

AISGILL REFLECTIONS.—II.

It was shown in our last article that on some of the Continental State Railways electricity is being exclusively adopted on all new passenger coaches, and that gas is being gradually superseded by electricity on existing trains. This change has only been brought about by the pressure of public opinion following on accidents similar in their after effects to those at Aisgill.

Many of the British railway companies did not wait for gas accidents to happen before experimenting with electric lighting; it was tried originally for the purpose of improving the lighting of the carriages, which, in the days of oil lamps, was quite insufficient for reading purposes. In those days long-distance passengers used to provide themselves with candles and carriage lamps, which were fixed to the windows or upholstery, and in the late eighties a company was formed for the purpose of enabling those passengers who wanted a good light to have electric light by paying for it. Several trains on the District and Metropolitan Railways were fitted with the Tourtel system, which was, briefly, the following :—Each coach was provided with an accumulator fitted under the seat of one of the compartments, and each compartment was fitted with several electric lamps fixed under the luggage rack. Near each lamp was fixed a box containing a clockwork mechanism, which could be set in motion by the insertion of a penny, and this also switched on the lamp, which was maintained alight for a definite time—an hour if we remember rightly. The system did not have a long life.

Among the earliest experiments in train lighting by electricity were those carried out on the Liverpool-Manchester section of the London and North-Western Railway about the year 1884. A "Tower" spherical engine, coupled direct to a dynamo, was mounted on the platform in front of the locomotive and supplied with steam direct from the boiler. This set was kept running continuously and supplied electric light to the carriages whilst they were attached to the locomotive. Obviously, if for any reason the engine had to be detached from the train, the lights were extinguished in the meantime. This disadvantage, together with the fact that the small rotary engine was a "steam-eater," probably accounted for the short life of this system.

As long ago as 1889 the Midland Railway Co., on the initiative of Mr. William Langdon, their electrical engineer, lighted several trains by means of axle-driven dynamos. The system employed was the patent of Mr. J. H. Holmes, of Newcastle-on-Tyne, and was devised to meet the conditions specified by Mr. Langdon, who described it fully in his paper on "Railway Train-Lighting," read before the Institution of Civil Engineers in May, 1891. The lighting had to be maintained at a practically constant voltage whether the train was standing or running at any speed up to the maximum in either direction. The main dynamo, which was fixed in the brake van, had two shunt windings, one of which was in series with the armature of a small auxiliary dynamo acting in opposition to the exciting E.M.F. of the main circuit. At full speed these E.M.F.'s

neutralised each other, so that the excitation was produced in the other shunt circuit by the battery only. As the speed fell, the excitation in the first shunt circuit rose and compensated for the fall in speed. When the speed fell below a certain minimum, a centrifugal governor switched the dynamo out of circuit, leaving the lights on the batteries. The system worked very well, but was discarded presumably owing to the introduction of the inverted gas mantle, which materially reduced the cost of gas lighting. Since then, however, the metal-filament electric lamp has neutralised the advantage which the gas mantle gave, but in the meantime incandescent gas lighting had become so general, and so much money was sunk in it, that railway companies were naturally loath to abandon it.

However, many of the leading companies have recognised the great advantages of electricity, and, having adopted it for lighting their sleeping and dining cars, are extending it gradually to their passenger coaches generally, and no doubt the recent accidents will hasten matters in this direction. Among the companies which have already adopted or are adopting electric lighting generally, are the Great Western, the Great North of Scotland, the Great Central, the L. & S.W., the South-Eastern and Chatham, the L.B. & S.C., the Great North of Ireland, the Midland Great Western, Ireland, the North Staffs., the Barry Railway, the Cheshire Lines, &c., and experience shows that the difference in cost between electricity and gas is slight when all things are considered.

The question of gas for cooking has been raised, but electrical cooking is now a proved commercial success, and as regards weight, we have it on the authority of large manufacturers of both gas and electric cooking stoves, that there is very little difference in this respect; designs are at present being got out for electric cooking equipments for some of the Continental railways.

While dealing with this subject, it is curious to note an historical parallel to the Aisgill collision dating back 21 years. In our issue of August 26th, 1892, on page 259, we published an article on "Railway Train Lighting," from which the following extracts are taken :—

The recent accident which occurred at Clapham Junction on the evening of the 20th will have brought before the public and the railway officials, in a forcible manner, the danger which accompanies the employment of gas as an illuminant for railway carriages. . . . . From it we learn what might be expected from gas-lighted trains in collision. We want no argument; the facts are before us, and from them we gather that on the evening in question the 9.50 p.m. train, Waterloo to Windsor, came into collision with a train of empties returning to Clapham Junction at or about 10.5 p.m., close beside the Ludgate Junction signal box. At the rear of the empties was a van—a composite, partly van and partly carriage—and adjoining it came three carriages, all third-class. With the rest of the vehicles we need not trouble ourselves. Into the tail of this train dashed the engine of the Windsor train with such force that the van was carried right over the engine and its tender, the two third-class vehicles in front of it being telescoped in the manner peculiar to such collisions. The guard of the empties was in this van, and was hurled among the *débris*. The gas became ignited, and an explosion is said to have instantly occurred; the brake van and the adjoining carriage were immediately in flames, and wholly, so far as inflammable parts were concerned, reduced to ashes within a very short time. The poor guard was sadly burned, and died within a few hours. Some passengers in the Windsor train complained of injuries, and the driver and fireman were also sufferers. . . . .

What a collision means we learn from the Clapham disaster, attended happily with comparatively slight results; but what would have been the end had those carriages, which were so quickly in a blaze, which were consumed to ashes in so short a time, been filled with human beings instead of being, as they were, empty? Doubtless that which was foreseen by Sir F. Bramwell, who evidently had in his mind the lamentable Abergelly accident, would have been the result, and a thrill of horror would have passed through the land. That which has happened has come to us as a warning—a warning shorn of much of its terrors—but still a warning of a very direct and unmistakable character. We have but to imagine those burnt vehicles filled with our fellow creatures, and the sum of the disaster is before us.

Will railway companies accept the lesson conveyed to them by the Clapham Junction accident? We question it. Will it induce them to foster that to which they must inevitably resort as a means of lighting their carriages? We hope so. We cannot think but that they will see in what has happened (and that the Board of Trade, for the same reason, will also see and impress upon the companies generally the propriety of considering their position), that should the accident be followed, as undoubtedly it, in the course of time, will be by another, the result may be something far more serious. If we concede that electricity is dearer than gas; if we concede that it is more troublesome to deal with in stock partially fitted, or stock in a state of transition; even then comes the question—the all-important question—of safety. Unquestionably, electricity is safer than gas. What if, after all these companies have fitted their stock with gas, the public outcry demands that gas shall not be used; the companies have another illuminant at their command which will afford an equally good light! The public are not, as a rule, considerate of the pockets of others; they will have what they wish, if it is to be had; and if they become terrified with mishaps of this character, some such demand may certainly be anticipated. In such a case, we should regret that electricity had not been more fully developed, for whatever might at such a time be its position, its application would have to be made, and the cost to which the companies had been placed for gas would be sheer loss.

It will be seen that the circumstances closely resembled those which obtained at Aisgill, and the warning then uttered was singularly prophetic; precisely what was foretold has come to pass, or is taking place before our eyes. The author of the article, who is no longer with us, was the electrical engineer to one of our greatest railways; and though we will not break the seal of his anonymity, we doubt not that the directors of the Midland Railway, at any rate, will recognise the hand.

THE RATING OF ELECTRICAL MACHINERY.

One of the most important matters discussed by the International Electrotechnical Commission at Berlin was the question of temperature limits for electrical machinery.

We have already mentioned that the permissible limits of observable temperatures recommended at Zurich in January of this year were adopted with only a few slight modifications. The Zurich meeting agreed upon the figure of 90° C. as the highest observable limit for impregnated cotton, and recommended 30° C. as the cooling-air temperature, but made no definite pronouncement in regard to the extremely important point of temperature rise. Probably 25° C. to 30° C. well represents the average cooling condition ordinarily met with in practice, but it is known that the cooling-air temperature at times rises considerably above this average value, and cooling-air temperatures between 35° C. and 40° C. are by no means unusual.

It has now been agreed that, instead of an average cooling-air temperature, the maximum probable temperature is to be given. Whilst at Berlin the majority were in favour of adopting 40° C. as representing the worst probable cooling-air conditions under which a standard machine might be required to operate in temperate climates, two or three favoured 35° C.; with a view, however, of arriving at a unanimous agreement, this point, as already mentioned, was wisely referred back to the National Committees for further consideration.

Under these conditions of maximum cooling-air temperature, the permissible limits of observable temperature specified for various insulating materials must never be exceeded, and the values adopted at Berlin and given in the table herewith represent the carefully considered opinion of the I.E.C. and are put forward as approved practice for continuous running.

The values are to apply only to windings for rotating machinery, the terminal pressures of which do not exceed 4,000 volts, and to dry transformers with solidly impregnated coils up to 10,000 volts.

The question of temperature limits for oil-immersed transformers has been deferred for future consideration.

We understand that experimental evidence justifies the assumption that in the above-mentioned windings to which the limits are to apply, the hottest internal spots will not be more than 10° C. in excess of the highest temperatures observable by the methods of measurement recommended by the I.E.C., and of which details will be given in the official report.

It is to be noted that the observable temperature limits permissible in windings for higher pressures than those stated above will be less than indicated in the table, so that the same temperature limits at the hottest internal spot shall not be exceeded. Thus for heavier insulations it will evidently be necessary to allow for a greater difference between the temperature at the hottest internal spot and the highest observable temperature, and, doubtless, specific figures to cover such cases will be recommended by the Commission later on.

Limits of Observable Temperature adopted by the I.E.C. in September, 1913.

Non-impregnated cotton	80° C.
Impregnated cotton or paper—general	90° C.
do. single layer field coils, stationary or moving	95° C.
do. stationary coils solidly impregnated throughout	95° C.
do. rotor and stator windings having the slot portion solidly impregnated or moulded...	95° C.
Enamelled wire (without cotton)	105° C.
Mica, micanite, asbestos—general	115° C.
do. single layer field coils, stationary or moving	120° C.
do. stationary coils solidly impregnated or moulded	120° C.
Windings permanently short-circuited :—	
Insulated	100° C.
Non-insulated	110° C.
Commutators—slip rings	90° C.
Bearings	80° C.

THE CADDER PIT DISASTER.

Home Office Inquiry.

On September 22nd Sir Henry Cunynghame, K.C.B., on behalf of the Home Office, opened an inquiry in the Justiciary Court, Glasgow, into the circumstances attending the disaster at Cadder Pit, Bishopbriggs, near Glasgow, whereby 22 lives were lost. The Home Office was represented by Mr. Robert Nelson, H.M. Electrical Inspector of Mines, and Mr. Wm. Walker, H.M. Chief Inspector of Mines for the Scotland Division, while counsel and solicitors represented the Carron Coal Co., the owners of the pit, and the Lanarkshire Mineowners' Association. Mr. Robert Smillie, and other miners' leaders, appeared on behalf of the British Miners' Federation and the Lanarkshire Miners' Union. There was a particularly large attendance of electrical experts in the Court when the inquiry opened, and these included Prof. Burns, Royal Technical College, Glasgow; Mr. A. B. Muirhead, Glasgow; Mr. Alexander Anderson, of Messrs. Anderson & Boyes, Motherwell; and Mr. David Martin, electrical engineer, Hope Street, Glasgow.

There was little that was of striking electrical interest in the opening day's evidence. Archibald Spiers, however, the manager at No. 15 Pit, Cadder Colliery, supplied the Commissioner with some details regarding the electrical equipment at the colliery. He explained that the generating plant in connection with the electrical installation was at No. 17 Pit. The wires, he said, were led above ground from No. 17 to a distributing board at the top of No. 15 Pit, and then taken down that pit. In connection with the supplying of electric light in the pit, the voltage was 500, and 100-volt lamps were arranged five in series.

Porcelain insulators of the flat type were used, and these were fixed on to the timber. These porcelain insulators extended only for a certain distance in No. 15 Pit, and after that string suspenders were used. That type of suspension was quite satisfactory. Since the fire in the pit it had been possible to see the cable as it originally was for a considerable distance in bye from the bottom of No. 15 Pit. The string suspensions were still intact, and if cables caused the fire it must have been those with the porcelain insulators. It was quite impossible that the fire could have had its origin in the electric motors, and he scouted the idea altogether that electricity was the cause of the outbreak.

When the inquiry was resumed on 23rd ult., the first witness called was Wm. Owens, overman at No. 15 Pit, Cadder Colliery. In reply to a question by Sir Henry Cunynghame as to whether the fire had been caused by some accidental action on the part of a miner, or whether the origin of the outbreak could be traced to the electric cables, witness said it might be due to carelessness on the part of a miner in throwing aside a match or a lighted cigarette in the vicinity of the cabin.

Before this fire, did anything come to your knowledge which led you to suspect that the cables, panels or any part of the electrical installation underground were not as they should be?—Nothing like that came to my knowledge, Sir.

By Mr. C. D. Murray, K.C., for the Carron Co.: Can you suggest any way at all how the electric cables, whether power or lighting, could have caused this fire?—I cannot.

John Lawson, engineman, said that on the night of the disaster he was in charge of the electrical generating station. On noticing that something was wrong with the switches, he tried to get into telephonic communication with the cabin and the switch panel room underground, but although he rang several times, he failed to get any response.

By Mr. Robert Nelson, H.M. Electrical Inspector of Mines: Was the leakage detector on the switchboard at No. 17 always switched in or was it sometimes in and sometimes out?—At times it was in and at other times it was out.

Edward Michael Flynn, electrician at No. 15 Pit Cadder Colliery, described the electrical apparatus in the pit where the accident occurred. He considered that the electrical fittings underground were arranged on generally satisfactory lines. Since May of the present year there had been no breakage or damage of cables beyond what might have occurred as a result of ordinary methods of working.

Mr. Nelson (to witness): Are you aware of the fact that there are cables in contact with the timber?—Yes, but that is since the fire.

By Mr. C. D. Murray, K.C.: Witness could say positively that it was only since the fire that the cables had come in contact with the timbers. Further, he had tested the insulation resistance in the cables which the timber came against, and it was absolutely satisfactory.

On 24th ult., Arnold Hughes, electrical engineer to the Carron Co., deposed that he had been in the employment of the company for seven years. There were resident electricians at the various pits, and his duty was chiefly that of supervision. Electricity was first introduced into No. 15 Pit about 14 years ago, and then only for lighting. It was not until 1906 that the company installed electrical power plant. In the spring of last year a further alteration was made, and armoured power cables were introduced to comply with the new Electricity Order. In the opinion of witness, armoured cables were preferable to, and much safer than, unarmoured cables. At the date of the fire the electric lighting circuit was in good order. His last examination of the plant in this pit was made on June 3rd last.

Speaking, then, from your knowledge of the system, are you of opinion that it is reasonably possible that it was those electric lighting wires which gave rise to the fire?—They did not, in my opinion, cause it.

Do you think that the cables could have given rise to the fire?—I do not.

Witness, in reply to Mr. C. D. Murray, K.C., said he did not give the slightest weight to the suggestion which had been made that any defect in the lighting cables had caused the fire. Tests and experiments had been carried out in his presence by Prof. Burns, Royal Technical College, Glasgow, and Messrs. Alex. Anderson and A. B. Muirhead, electrical engineers, and these satisfied him that there were no defects in the lighting cables. The cables which had survived the fire had been subjected to certain insulation tests, and these had proved most satisfactory.

Mr. Nelson at this stage said he had tested the surviving cables, and admitted that these came up to the standard of requirements.

Dr. W. M. Thornton, Professor of Electrical Engineering in Armstrong College, Newcastle, who was afterwards called, said he had made a special study of the possible risk of fire attending the use of electricity in coal mines. On September 22nd he made an examination of the electrical plant at No. 15 Pit, Cadder Colliery, and his opinion was that the plant, considering the pit was a naked light one, was quite good. So far as the lighting cables in the pit were concerned, it would have been better if these had been armoured. The power cables were insulated with vulcanised bitumen, and he had found recently that bitumen was rather dangerous in certain conditions associated with cables.

Has any new factor been brought to light in the present inquiry into this disaster upon which you wish to express an opinion in so far as it relates to the use of electricity in the mines in future?—In the first place it seems to me that we have evidence now to show that bitumen cables in mines do burn very freely for quite a considerable distance.

Witness, in the course of further examination, said he held to the opinion that the leakage indicators should have been constantly in use. He further held that readings should be taken a little more frequently than they were done, while he considered it would be an advantage if in every pit they could have automatic cut-outs.

On Thursday, September 25th, the Commissioner said that to suit the convenience of Mr. Robert Nelson, who was desirous of getting away, he would take his evidence now.

In reply to the Commissioner, Mr. Nelson said he had had a large experience, since his appointment, in dealing with electrical accidents that had occurred.

Now, from your knowledge of electricity in general, you will say, I presume, that electricity might have been the cause of this fire?—Yes. The conditions I saw at Cadder Colliery are exactly those which I had seen in other cases in which undoubtedly the fire had an electrical origin.

You would not be surprised that other inspectors of mines, gentlemen of experience in mining, would put the origin of the fire down to another cause?—Not at all. Probably their opinion would be of more value on the whole than mine. They would be better familiar with the whole conditions of the mine than I am.

By Mr. Smillie: It has been said by some of the electrical witnesses that electricity could not possibly have caused that fire. What have you to say in regard to that?—Well, I place my greater experience against the evidence of these witnesses.

Do you argue that the possibilities of electricity causing this fire have been placed by witnesses rather too low?—Very emphatically I argue that.

Examined by Mr. C. D. Murray, K.C., for the Carron Co., witness stated that he knew the case of a cable which burst into flame while the men were looking at it.

Witness, in further reply to a question by Sir Henry Cunynghame, said he saw the electrical possibilities in this pit much more clearly, perhaps, than mining engineers did, and it was his evidence that the fire might have been caused in that way.

The report of the Commissioner will be issued in due course.

Olympic Fund.—The Duke of Westminster's Olympic Fund is the central fund to which subscriptions should be sent. Letters containing cheques, postal orders, and stamps should be addressed to the Duke of Westminster at Grosvenor House, London, W. Cheques and envelopes should be marked "Olympic Fund." All individual contributions, as well as collective subscriptions from a farthing upwards, will be acknowledged by him and forwarded to the honorary treasurer of the special committee, Mr. E. Mackay Edgar, Basildon House, Moorgate Street, London E.C.

Mr. Thos. Farrow, of Farrow's Bank, Ltd., proposes that 100 of the large trading and financial concerns of the country shall each raise £250 or £500, and has undertaken that his firm shall contribute £500, besides giving £250 himself.

Lignite Coal in Canada.—The Saskatchewan Government is about to erect plant for developing and testing the lignite coal of the Esteran district. In North Dakota similar lignites are partially carbonised, the product being practically lump charcoal, which can be used in gas producers, under boilers, and for domestic purposes, having about the same heating value as anthracite, but being less dense. The fine carbon screened out of the lump is briquetted, and can then be used for similar purposes. The possibility of establishing a large central electric power plant at the mines to distribute electricity over a wide radius is receiving attention.—*Canadian Engineer.*

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Proposed New Brazilian Tariff.

The Board of Trade have issued a translation of a new draft Customs Tariff for Brazil with a comparison of the proposed and existing rates of duty. We reproduce below details as to the existing and proposed rates for electrical and similar goods with particulars of alterations in tare allowances when such effect a difference in the amount of duty payable; it will be noticed that in some cases these alterations in tare allowances would have a considerable effect. It is understood that the Draft Tariff will be revised "in the light of such representations from interested parties as may be received by September 30th by a Committee presided over by the Minister of Finance, and that the work of this Committee will subsequently be submitted to the Brazilian Congress." It is considered improbable that the new tariff will become law during the current year. The principal alterations proposed to be made in the Preliminary Dispositions to the Tariff, are as follows:—

1. That all duties shall be payable 40 per cent. in gold, and 60 per cent. in paper.

2. That for the purpose of assessing *ad valorem* duties, the declared or appraised value of the goods is to be converted into milreis at the rate of 16d. to the milreis.

It will be realised that these alterations in the dispositions vitally affect the amount of duty payable on a number of goods, in addition to the effect of alterations in the actual rate of duty itself.

	Proposed tariff. Reis per kilog.	Existing tariff. Reis per kilog.
Leather belting for machines	2,000 (gr. weight)	2,400 (net w'ght)
Asbestos: Cord or string ...	1,000	940
Cloth, packing combined or not with wire or rubber.	1,000	1,100
Sheets, combined or not with wire or rubber.	500	500
Articles not specifically mentioned in the tariff.	20%	20%
Earthenware conduits or pipes	100	100
Receptacles and vessels of earthenware for batteries, insulators or any articles combined or not with copper for electric installations.	200	200

Tare allowances for two previous headings: Proposed: In barrels, cases, hampers or baskets 25 per cent., in any other packages gross. Present: In barrels or cases 8 per cent.

Carbons prepared for electricity	200	200
China vessels for batteries, insulators, buttons for electric bells and all other articles of china with or without copper for electric installations	200 (gr. weight)	200 (net weight)

Note.—Brackets not soldered on and screws dutiable separately

Glass insulators for telegraph and telephone poles.	100 (tare 35%)	100 (tare 40% and 30% according to packing)

Note.—As for previous heading.

Glass vessels for batteries ...	400 (cases 40%, cardboard gross)	400 (cases 45%)
Bells of copper or brass of various kinds, and gongs: Electric with cases of wood, iron or any other material for whatever use.	3,600	4,000
Copper wire: Plain	400 (cases 10%)	400 (cases 20%)
Covered with paper, cotton or rubber, or with any other composition, for submarine or underground cables, for telegraphs, telephones, power, &c.		
With sheath of lead or iron	20% ad val.	20% ad val.
Without such sheath ...	900 (barrels 15%, cases 15%)	900 (barrels 10%, cases 20%)
Zinc rods for electric batteries	100	100
Iron wire, plain or galvanised	100 (barrels or cases 10%)	100 (cases 20%, barrels 10%)
Iron wire covered with paper or tissue.	1,000 (barrels or cases 10%)	1,200 (cases 20% barrels 10%)
Rails	25	50 and 15 according to weight.
Flexible and other pipes for electric installations.	120 (barrels or cases 10%, other, gross).	Not specified.
Electro-galvanic or electro-magnetic rings, belts, &c.	16,000	16,000
Volta's condensing electroscope	5,000 each.	5,000 each.
Electric lamps: Incandescent	2,000 per kg.	Not specified.
Arc... ...	15 % ad val.	Not specified.

Note.—Glasses for manufacture of incandescent lamps shall pay duty at the rate of 600 reis per kg. gross.

Dry batteries	100	Not specified.
Electrical apparatus not mentioned in the tariff.	15 % ad val.	15 % ad val.
Driving or transmission apparatus.	150	8 % ad val
Machine belting of cotton, rubber and the like, even when imported with the machines to which they belong.	1,800	1,800
Lifts complete or not excluding the motor.	30 % ad val.	Not specified.
Steam, electric, hydraulic and travelling cranes.	15 % ad val.	15 % ad val.
Machines for mines, factories, workshops and navigation, propelled by steam, water, gas, air, wind, electricity or animal power.	15 % ad val.	8 % ad val.
Motors, stationary, locomotive, or portable, such as: dynamos, and other electric motors for power and light, locomotives and their tenders, locomobiles, hydraulic motors (turbines and hydraulic wheels), windmills and all others.	15 % ad val.	8 % ad val.

Note.—The following articles, which usually accompany locomobiles, shall be included in the value on which duty is assessed: one oilcloth or tarpaulin, the firemen's tools, one brush for cleaning the pipes, one oil cup, a complete set of nut wrenches, three glass tubes for water-gauges, one suction pipe not exceeding 5 metres in length, with its filter (*ralo*).

The following shall be deemed to form integral parts of locomotives, viz., the wheels with their axles, the tires, the boilers and furnaces, even if imported separately, as well as the cylinders, valves and compressed air or vacuum apparatus belonging to locomotives.

Wheels of locomobiles, with their axles and cranks, shall only be considered as integral parts of such engines when imported therewith.

Water and steam pipes connecting the boiler and the motor, as also fly-wheels and transmission pulleys, are considered as integral parts of locomobiles and of all other motors.

Pipes or joints of iron or steel imported with turbines are considered as forming integral parts thereof on condition that, taken together, they do not exceed 30 metres in length.

Lightning rods: Complete, with several branches, plain or with a platinum point.	15,000 each.	15,000 each.
Single branch, plain or with platinum point.	6,000 each.	6,000 each.
Note.—Complete lightning rods do not include the conducting cables.		
Machine tools, not specially mentioned.	400 (barrels or cases, 10%)	300 (barrels 20%, cases 10%)
Machinery and exploitation materials for use in mines imported direct by the mines for their own use (includes plant for electric lighting, &c.)	Free.	

Copper.—To judge by the mid-monthly figures, as shown by Messrs. Merton's circular, demand is still brisk, and supply lagging behind. The total deliveries (European) up to September 15th, 1913, were 24,965 tons. North America contributed more than the average quantity for a fortnight; Spain and Portugal, always a fluctuating quantity, a good deal less; Chile shipments were fairly high, and Australian well up. The stock in England and France and afloat thereto from Chile was 26,011 tons, of which England held 16,071 tons, 758 tons less than on August 30th. Total European stocks, including Rotterdam, Hamburg and Bremen, and 850 tons estimated in other ports, were 32,788 tons, 1,667 tons less than at the end of August.

American stocks, as shown by the American Producers' Association figures are also very low, being only 17,104 tons at the end of August, or 6,822 less than for the end of July. The total visible supply from all sources at the end of August was 51,149 tons, a decrease during the month of 8,404 tons.

Institution of Mining Engineers.—On Wednesday last week the annual general meeting of this Institution was opened at Manchester; the Deputy Lord Mayor welcomed the members to the city, and the Council's report was submitted, after which a number of papers were discussed. In the afternoon the works of Messrs. Mather & Platt, and the Pilkington Tile and Pottery Co., were visited, and the annual dinner took place in the evening. On Thursday and Friday various other excursions were made, including one to Messrs. W. T. Glover & Co.'s electric cable works, and one to the National Gas Engine Co.'s works. On Thursday evening a lecture was given by Prof. H. B. Dixon, on "Explosion Experiments at Eskmeals," followed by a reception in the Museum of the University.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

20,773. "Automatic telegraph systems." D. H. CAMERON. September 15th (Complete.)

20,779. "Galvanic filter-cells." G. ENGISCH. September 15th.

20,792. "Electric cooking apparatus." N. PRENTICE. September 15th.

20,796. "Recording galvanometers." P. BRAUN & Co. (Convention date, September 14th, 1912, Germany.) September 15th. (Complete.)

20,798. "Process and apparatus for establishing synchronisation by means of electric waves." M. P. OTTO. (Convention date, September 16th, 1912, France.) September 15th. (Complete.)

20,800. "Ignition devices for explosion or internal-combustion engines." P. E. DE FIAL. (Convention date, February 26th, 1913, Hungary.) September 15th. (Complete.)

20,806. "Apparatus for the production and radiation of electrical oscillations." F. MILLER. September 15th. (Complete.)

20,821. "Vapour electric apparatus." E. E. DARMOIS and M. A. E. LEBLANC. September 15th.

20,822. "Multiple telephony." H. TIETGEN. September 15th.

20,853. "Electrically-operated winch specially applicable as an ash hoist." G. F. D. CAMPBELL. September 16th. (Complete.)

20,856. "Telephone exchange systems." ZIVNOSTENSKA BANKA v. PRAZE (Firm of). (Convention date, October 28th, 1912, Austria.) September 16th. (Complete.)

20,870. "Means for operating electric switches from a distance." SIEMENS BROS. DYNAMO WORKS, LTD., F. LYDALL and R. BROOKS. September 16th. (Complete.)

20,878. "Process for the electro-deposition of iron." S. O. COWPER-COLES. September 16th.

20,909. "Automatic means for operating and controlling devices used in charging and/or discharging secondary batteries." C. H. DE RUSETT. September 16th.

20,912. "Commutator trueing devices." F. G. LUDWIG. September 16th. (Complete.)

20,929. "Sparking plugs for electric ignition purposes." UNITED MOTOR INDUSTRIES, LTD., and E. DE RODAKOWSKI. September 16th. (Complete.)

20,933. "Method of producing electric insulators." W. BOEHM. September 16th. (Complete.)

20,934. "Electric heating devices." JACKSON ELECTRIC STOVE CO., LTD., and F. H. WILLIAMS. September 16th.

20,937. "Production of high-tension discharges." W. H. WILSON. September 16th.

20,990. "Electric torch." J. AIKMAN, JUN. September 17th.

21,029. "Electric glow-lamps, and/or the method of manufacturing and operating the same." C. O. BASTIAN. September 17th.

21,033. "Wire-strainers." E. E. MOFFITT. September 17th.

21,036. "Telegraphic receiving apparatus." J. GELL. September 17th.

21,050. "Electric locks for lift-gates and doors." C. G. MAJOR, P. H. STEVENS, and SMITH, MAJOR & STEVENS, LTD. September 17th.

21,069. "Means for mounting the terminals of electric lampholders or other coupling members, and electrically connecting wires therewith." G. ST. J. DAY. September 18th.

21,070. "Contact surfaces of electrical coupling devices." G. ST. J. DAY. September 18th.

21,109. "Electrical resistances." C. E. HAY and H. W. SULLIVAN. (Divided application on 22,575, 1912. March 18th, 1913.) September 18th. (Complete.)

21,115. "Submarine electric lamps." R. H. DAVIS. September 18th. (Complete.)

21,126. "Apparatus for selecting circuits, especially for automatic telephone systems." L. PREECE. September 18th.

21,140. "Regenerative braking systems for electric motors." N. W. STORER. (Convention date, October 5th, 1912, United States.) September 13th. (Complete.)

21,143. "Voltmeter." J. STEPHENSON. (Convention date, September 18th, 1912, Germany.) September 18th. (Complete.)

21,186. "Electromagnetic lifting appliances." H. VON KRAMER and A. H. RAILING. September 19th.

21,191. "Illuminators or reflectors applicable to electric and other advertising signs and the like." H. GOULTON.

21,193. "Counter-weights for pendant electric light fittings." G. H. GYTON. September 19th.

21,222. "Circuit arrangements for connectors with multiple connections." SIEMENS & HALSKE AKT. GES. (Convention date, November 9th, 1912, Germany.) September 19th. (Complete.)

21,283. "Sparking plugs." H. G. LONGFORD, W. W. LONGFORD and SPHINX MANUFACTURING CO. September 20th.

21,309. "Electric tension dividing devices." SOC. SCHNEIDER & CIE. (Convention date, October 31st, 1912, France.) September 20th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

SELF-STARTERS FOR AUTOMOBILES AND THE LIKE. W. E. Lake. (United States Light and Heating Co.) 19,514. August 26th.

ELECTRIC SIGNALLING SYSTEMS. Sir A. T. Dawson and G. T. Buckham. 19,585. August 27th. (Cognate application No. 5,537 of 1913.)

MECHANICAL DEVICE FOR OBTAINING SYNCHRONISM OF THE CINEMATOGRAPH WITH THE PHONOGRAPH. H. Porter, G. Schaible and F. Darragon. 19,593. August 27th.

ELECTRICALLY-HEATED COOKERS. A. J. Kercher. 19,754. August 29th.

ELECTRICALLY-HEATED COOKERS. A. J. Kercher. 19,771. August 29th.

ELECTRICALLY-PROPELLED ROAD VEHICLES. E. Cross. 19,825. August 30th.

MEANS FOR FIXING ELECTRICAL AND OTHER FITTINGS TO CONCRETE AND FERRO-CONCRETE AND LIKE STRUCTURES. A. H. Taylor and H. A. Pinney. 19,921. August 31st.

MEMORANDUM AND LIKE APPLIANCES FOR USE IN CONNECTION WITH TELEPHONES AND FOR OTHER PURPOSES. E. F. M. Branson and F. H. Bowden. 20,293. September 6th. (Cognate application No. 26,947 of 1912.)

PORTABLE ELECTRIC LAMPS. Hartmann & Braun Akt.-Ges. 21,917. September 26th. (September 30th, 1911.)

ELECTRO-MAGNETIC APPARATUS, APPLICABLE FOR TELEPHONIC AND THE LIKE SIGNALLING AND OTHER PURPOSES. M. S. Conner and A. R. Kahl. 24,089. October 22nd.

METHOD AND APPARATUS FOR STARTING MULTI-CYLINDER INTERNAL-COMBUSTION ENGINES. Robert Bosch (Firm of). 24,533. October 26th. (December 16th, 1911.) Patent of Addition not granted.)

ELECTRO-MAGNETO GENERATOR. W. P. Thompson. (Splitdorf Electrical Co. 26,323. November 16th.

FIRE AND TEMPERATURE ALARMS. J. Hartley. 27,473. November 29th.

ELECTRIC INSULATORS. A. R. Muller. 27,788. December 2nd.

ELECTRIC ADVERTISING DEVICES AND SIGNS. E. H. Bickley. 29,881. December 28th.

METALLISING CERAMIC AND OTHER SURFACES. Q. Marino. 12,642. May 29th.

ALTERNATING-CURRENT ELECTRIC MOTORS. L. Rouzet. 12,687. May 29th.

METHOD OF, AND MEANS FOR, PROTECTING ELECTRIC CIRCUITS AGAINST HIGHER OSCILLATIONS. F. A. Becker. 12,908. June 1st. (Convention date not granted.)

SIGNALLING APPARATUS FOR RAILWAYS. H. Jennings. 16,678. February 17th. (February 17th, 1913.)

ELECTRICAL MASSAGE APPARATUS. G. W. Mascord. 19,661. August 28th.

MUSICAL INSTRUMENTS WITH ELECTRICALLY-OPERATED VIBRATORY SOUNDERS. M. L. Severy and G. B. Sinclair. 19,869. August 30th.

ELECTROLYTIC PICKLING OF METALS. P. Marino. 20,180. September 4th.

ELECTRICALLY-PROPELLED AND OPERATED AGRICULTURAL MACHINES. W. Wortmann. 20,185. September 4th.

DIRECT-CURRENT GENERATORS. A. E. Berdon. 20,225. September 5th.

ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 20,662. September 10th.

SYSTEMS OF ELECTRIC MOTOR CONTROL. British Thomson-Houston Co. (General Electric Co.) 20,744. September 11th.

SWITCHES OF THE TUMBLER KIND. W. J. Charles. 22,477. October 3rd.

SECONDARY ELECTRIC CLOCKS. W. J. Parker. 21,274. October 24th.

ALTERNATING-CURRENT GENERATORS. Ateliers de Constructions Electriques du Nord et de l'Est. 25,207. November 4th. (November 8th, 1911.)

ELECTRIC HEATING DEVICES FOR BUILDINGS AND VEHICLES. T. J. Digby. 26,356. November 15th.

ELECTRIC RAILWAY SYSTEMS. W. B. Purvis and A. D. Gritman. 26,344. November 16th.

ELECTRIC HEATING DEVICES. M. Albrecht. 26,347. November 16th.

ELECTRIC METERS AND METER SYSTEMS AND RELAYS ADAPTED TO CONTROL THE SAME AND FOR OTHER PURPOSES. Siemens Schuckertwerke Ges. 26,439. November 18th. (November 17th, 1911. Addition to No. 25,831 of 1912.)

MANUFACTURE OF FILAMENTS FOR ELECTRIC LAMPS. British Thomson-Houston Co. (General Electric Co.) 27,433. November 28th.

ELECTRIC LAMPS FOR MINES. H. Joris. 28,816. December 14th.

EAR AND MOUTH PIECE PROTECTORS FOR TELEPHONES. E. Dannenberg. 30,111. December 31st.

1913.

ELECTRIC OIL SWITCHES. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 148. January 2nd.

ELECTROMAGNETICALLY-OPERATED DIAPHRAGM HORNS AND THE LIKE. E. A. Graham. 318. January 4th.

TELEPHONY AND LIKE SYSTEMS. E. A. Graham and W. J. Rickets. 1,049. January 14th. (Addition to No. 10,045 of 1911.)

ELECTRIC CLOCK MECHANISMS. F. T. Reid. 1,243. January 16th. (August 22nd, 1912.)

RECEPTACLES FOR DIAPHRAGM-GUARDS FOR TELEPHONE MOUTHPIECES. F. Loewenstein. 3,387. February 10th.

REFILLABLE ELECTRICAL FUSES. J. G. Clemens and Monarch Refillable Fuse Co. 3,571. February 11th.

ELECTRICALLY-HEATED COOKING AND LIKE UTENSILS. J. Mann. 4,479. February 21st.

AUTOMOBILE SIGNALS. J. G. Marsh. 4,816. February 25th.

METHOD OF AND MEANS FOR ADVERTISING. M. Heinig and A. C. Graeger. 4,957. February 26th. (February 26th, 1912.)

COMMUTATORS FOR DYNAMO-ELECTRIC MACHINERY. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke Ges.) 6,648. March 18th.

SHIPS' COMPASSES. L. W. P. Chetwynd and Dent & Co. and Johnson, Ltd. 6,702. March 18th.

ELECTRICAL DISTRIBUTION SYSTEMS. British Thomson-Houston Co. and E. B. Wedmore. 6,807. March 19th. (Divided application on No. 28,868 of 1911, July 22nd, 1912.)

ELECTRIC PLUG CONTACTS. A. Schuchardt. 7,243. March 26th.

TELEGRAPHIC TRANSMISSION. C. Schou. 13,089. June 5th.

ELECTROLYTIC ELECTRODES. Schott & Gen. 17,759. August 2nd. (August 21st, 1912.)

COMBINED DYNAMO REGULATORS AND SWITCHES. E. O. Van Kerckhoven. 1,512. January 18th. (February 3rd, 1912.)

SAFETY SIGNALLING APPARATUS FOR USE IN MINES. J. Close. 2,546. January 31st.

WIRELESS TELEGRAPHY OR TELEPHONY. Signal Ges. 3,246. February 7th. (February 12th, 1912.)

ELECTRICITY METERS. J. Elster. 3,466. February 10th.

ELECTRIC DRIVING MECHANISM FOR SPINDLES, FLYERS OR SIMILAR PARTS USED IN MACHINES FOR WORKING TEXTILES. Soc. l'Eclairage Electrique. 3,759. February 13th. (April 16th, 1912.)

SUBMARINE SIGNALLING APPARATUS. E. C. R. Marks. (Submarine Wireless Co.) 5,082. February 28th.

INSULATING GLOVES. St. Helens Cable and Rubber Co. and H. Evans. 5,242. March 1st.

FORM OF CONTACT FOR ELECTRIC BELLS, ALARMS AND THE LIKE. J. H. Cunnington. 7,755. April 2nd.

MEANS FOR USE IN DIRECTLY MEASURING SMALL VARIATIONS OR DIFFERENCES IN ELECTRICAL RESISTANCE. Hartmann & Braun Akt.-Ges. 8,602. April 11th. (May 8th, 1912.)

REGULATORS FOR ELECTRIC IGNITING APPARATUS. J. Schulz. 8,738. April 14th. (November 29th, 1912.)

GUARDS FOR THE STAY WIRES OF TELEGRAPH, TELEPHONE OR OTHER POLES. A. Rogers-Jenkins. 9,869. April 26th.

FIRE ALARMS. J. Stevens. 11,218. May 13th.

MEANS FOR AUTOMATICALLY OPERATING ELECTRICAL SWITCHES FOR STOPPING AND RESTARTING MOTORS FOR COMPRESSING AIR AND OTHER FLUIDS INTO CYLINDERS AND OTHER RECEIVERS. T. C. Walter and Displayer Co. 12,218. May 26th.

SWITCH ARRANGEMENTS FOR ELECTRIC HEATING APPARATUS. R. Weaving and Ferranti, Ltd. 12,935. June 4th. (Divided application on No. 17,837 of 1912, August 1st.)

METHOD OF IGNITING AND UNLOCKING MINERS' SAFETY LAMPS. W. W. Gordon and J. Wright. 13,694. June 13th.

MUSICAL INSTRUMENTS WITH ELECTRO-MAGNETICALLY-VIBRATED SONOROUS BODIES. M. L. Severy and G. B. Sinclair. 16,860. July 22nd. (Divided application on No. 19,869 of 1912, August 30th.)

APPARATUS FOR REGULATING THE LIGHT INTENSITY OF ELECTRIC ARC LAMPS. Siemens-Schuckertwerke Ges. 17,086. July 25th. (July 25th, 1912.)

MEANS FOR PREVENTING EXCESS VOLTAGES IN ALTERNATING ELECTRIC CIRCUITS F. A. Becker. 19,029. August 21st. (Divided application on No. 12,908 o 1912, June 1st.)